SHARED HISTORIES: TECHNOLOGY AND COMMUNITY AT GILUND AND BAGOR, RAJASTHAN, INDIA (c.3000-1700 BC)

Teresa P. Raczek

A DISSERTATION

in

Anthropology

Presented to the Faculties of the University of Pennsylvania in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy

2007

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Supervisor of Dissertation

____
Graduate Group Chair

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ABSTRACT

SHARED HISTORIES: TECHNOLOGY AND COMMUNITY AT GILUND AND BAGOR, RAJASTHAN, INDIA (C. 3000-1700 BC)

Teresa P. Raczek

Gregory Possehl

This dissertation examines the relationship between two contemporaneous sites in southeastern Rajasthan: Gilund, a permanent settlement of agro-pastoralists and Bagor, a temporary camp inhabited by people who employed a mixed subsistence strategy. Gilund and Bagor are located 30 km apart in an area known as the Ahar-Banas Cultural Complex (3000 to 1700 BC). Artifacts found in the initial excavations linked Bagor with the inhabitants of permanent settlements in the region. However, the nature of interaction was largely uncertain. Recent excavations at both sites provided the opportunity to study the lithic collections anew. Lithics were selected for analysis because they were the single artifact class found in abundance at both sites.

This project employed three avenues of research. First, evidence for the presence of overlapping material landscapes was sought by examining raw material procurement. A targeted field survey of chert and chalcedony sources identified potential sources and was paired with a visual raw material analysis of samples and artifacts. Second, technological practices were examined using standard typologies and attribute analysis. Finally presence of a shared technological skill set was identified through a detailed analysis of core production.

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The results show many similarities between the two lithic assemblages. Both sites emphasize highly local raw material procurement, with some use of non-local materials. While both sites procured material from the southeast, the Bagor collection contained more chert from unidentifiable sources, indicating a broader material landscape than Gilund. Few differences in technological practices were evidenced in the typological and attribute analyses. Finally, both sites employed a variety of core production strategies, but shared common techniques including the use of a burinated core initiation.

Previous explanations described two separate groups that were loosely linked through exchange. However, this study shows that even though the inhabitants of these Gilund and Bagor engaged in distinct daily practices and raw material procurement patterns, these two communities shared a common skill set. That is, the evidence from lithic analysis suggests the presence of two communities with a shared history.

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TABLE OF CONTENTS

Acknowledgements iv
ABSTRACT ix
List of Tables..xv
List of Figures.. xvii
Chapter 1. Introduction..1
Introduction 1
Variation in Mobility and Economic Strategies 5
Ethnographic Models..5
Exchange as Interaction in Archaeology 7
Archaeological Evidence..8
The Mewar Plain 9
Gilund 13
Bagor 13
Third and Second Millennium BC Interaction in the Mewar Plain..15
Lithics in the Mewar Plain..17
Plan of the Work:..19
Summary of Chapter 2: The Region..19
Summary of Chapter 3: Hunters, Pastoralists, Farmers..19
Summary of Chapter 4: Lithics 20
Summary of Chapter 5: Lithics in South Asia..20
Summary of Chapter 6: Method and Data..21
Summary of Chapter 7: Discussion and Conclusion..21
Chapter 2: The Region—Geology and Occupation..22
Geography 22
Climate..26
Paleolithic Occupations..27
Mesolithic Occupations..27
Prehistoric Occupations in Rajasthan and Surrounding Areas..28
Ganeshwar-Jodhpura 31
Kayatha..32
Deccan Chalcolithic..32
The Ahar-Banas Cultural Complex 33
The Archaeological Surveys..35
The Excavations 37
Site by site descriptions:..39
Ahar 39
Balathal..42
Marmi 45
Ojiyana..47
Gilund 49
Bagor 51

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Occupation of the Mewar Plain in the First Few Millennium BC....54
Chapter 3. Conceptualizing Hunter-gatherers, Pastoralists, and Farmers....60
Introduction....60
Evolutionary Frameworks....61
Ethnographic Models—Economy....63
Ethnographic Models of Hunter-gatherers....63
Ethnographic Models of Pastoralists....66
Ethnographic Models—Mobility....68
Mobility of Hunter-gatherers....68
Mobility among Pastoralists....69
Ethnographic Models—Community and Ethnic Affiliation....72
Ethnic Affiliation and Hunter-gatherers....74
Ethnic Affiliation among Pastoralists....75
Exchange in Theory....77
Hunter-gatherers in South and Southeast Asia....80
Pastoralists in South Asia....83
Archaeological Examples of Interaction....85
The Spread of Agriculture....88
"Mesolithic" and "Neolithic"....89
Shifting Mobility and Subsistence in the Mesolithic-Neolithic Transition....90
South Asia....92
Archaeological Examples of Interaction in India....94
Gilund and Bagor....99
Conclusion....101
Chapter 4. Lithics....104
Introduction....104
Lithic Assemblage Variability....104
Mobility and Sedentism....104
Subsistence and Other Practices....108
Raw Material Acquisition....110
Interplay of Multiple Factors....114
Raw Material....115
Core Production....119
Platforms....120
Initiation....120
Raw Material....122
Intensity of Use....123
Technique....124
Desired End Product....125
Reason for Discard....126
Shape....126
Lithics and Technology....129
Biography of Lithics....129
Social Context....132
Skill Acquisition and Technological Knowledge....136

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Conclusion 138
Chapter 5. Lithics in South Asia 141
Introduction 141
Mesolithic in South Asia 142
Mesolithic Assemblages in South Asia 149
Chalcolithic Assemblages in South Asia 151
Assemblage Variation 151
Crested Ridges 153
Alternatives to the Crested Ridge 158
Core Studies in South Asia 159
Core Typologies 160
Discussion 166
Chapter 6. Method and Data 168
Introduction 168
Field Survey 169
Semara (District Chittaurgarh) 173
Bagor (District Bhilwara) 175
Chatrikhera (District Rajsamand) 176
Nathdwara (District Rajsamand) 176
Banas River 176
Jahazpur Range (District Bhilwara) 177
Surawada, Jashma, Railmagra (District Rajsamand) 177
Bhagwanpura (District Udaipur) 177
Chitauriya (District Udaipur) 178
Berugati (District Udaipur) 179
Survey Summary 179
Gilund Excavations 189
Bagor Excavations 192
Collections Analysis 194
Selection of Samples 194
Methods of Lithic Analysis 198
General Description of Collections 205
Overview of Types 205
Tools 207
Backing and Truncations 209
Truncations 212
Platform Preparation 213
Measurements 216
Length 216
Width 223
Thickness 224
Weight 226
Core Type 228
Raw Material 229
Blade core shape 230

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Core Platform and Body Preparation....233
Blade Core Platform Edge Preparation....235
Core Body Preparation....235
Initiation....237
Burin-like Initiation....239
Initiation Location....239
Platform Count....240
Removal Direction....241
Removal Location....242
Butt....242
Preparation of Back....243
Back Shape....244
Bottom Preparation....245
Order of Preparation....245
Potential Cause of Discard....246
Raw Material Analysis....247
Quartz....248
Chalcedony....248
Other Raw Materials....249
Chert....254
Summary....264
Field Survey and Raw Material Analysis....264
Typology and Attribute Analysis....265
Core Analysis....267
Chapter 7. Discussion and Conclusion....269
Material Landscapes and Raw Material....270
Lithic Assemblages: Variability and Technological Practices....273
Core Production....275
Bagor, Gilund, and the Ahar-Banas....278
Broader contributions....279
Social Difference....279
Lithic Technology....280
Archaeology of South Asia....280
Remaining Questions....281
Conclusion....283
Appendix 1—Site Survey Transect Form....286
Appendix 2—Surface Collection Form....288
Appendix 3—Site Summary Form....290
Appendix 4—Illustrations of Lithics....293
Appendix 5—Select Core Photos....321
Bibliography....330
Index....378

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List of Tables

Table 2.1: Chronology of Excavated Ahar-Banas Sites.......................................38
Table 2.2 Gilund Radiocarbon Dates...50
Table 5.1 Radiocarbon Dates of Sites in South Asia with "Mesolithic" layers.........147-9
Table 5.2 Core Typologies in South Asia...164-6
Table 6.1 Lithics Collected at Semara A..181
Table 6.2 Lithics Collected at Semara B..182
Table 6.3 Lithics Collected at the Site of Bhagwanpura.................................183
Table 6.4 Lithics Collected at the Site of Berugati.......................................184
Table 6.5 Lithics Collected at the Site of Chitauriya.....................................185
Table 6.6 Count of Study Sample Lithics per Trench at Gilund..........................196
Table 6.7 Attributes Recorded (excluding raw material and core attributes)............202
Table 6.8 Core Attributes Recorded...203
Table 6.9 Raw Material Attributes Recorded..204
Table 6.10 Dataclass by Site...206
Table 6.11 Distribution of Tool Types for Each Site......................................209
Table 6.12 Blade and Flake Backing...210
Table 6.13 Location of Backing...211
Table 6.14 Type of Backing (blades backed on one-edge only)..........................212
Table 6.15 Summary of Truncations..213
Table 6.16 Truncations on backed and non-backed blades...............................213
Table 6.17 Blade Platform Preparation..215
Table 6.18 Flake Platform Preparation...216
Table 6.19 Length by Dataclass and Raw Material (mm)..................................218
Table 6.20 Width by Dataclass and Raw Material (mm)...................................224
Table 6.21 Thickness by Dataclass and Raw Material (in mm)...........................226
Table 6.22 Weight by Dataclass and Raw Material (in grams)............................227
Table 6.23 Core Types by Site...229
Table 6.24 Core Types by Raw Material and Site...229
Table 6.25 Blade Core Shape Descriptions...230
Table 6.26 Blade Core Shapes by Site...231
Table 6.27 Distribution of Cores among Simplified Core Shape Categories............232
Table 6.28 Blade Core Platforms by Site (complete cores only)..........................233
Table 6.29 Blade Core Platforms by Raw Material and Site (complete cores only)......234
Table 6.30 Flake Core Platforms by Site (complete cores only)..........................235
Table 6.31 Blade Core Platform Edge Preparation...235
Table 6.32 Blade Core Body Preparation (complete cores only)..........................237
Table 6.33 Blade Core Initiation Technique (complete cores only).......................238
Table 6.34 Blade Core Initiation and Raw Material (complete cores only)..............238
Table 6.35 Initiation Location..240
Table 6.36 Blade Core Platform Count 241
Table 6.37 Direction of Blade Removals..241
Table 6.38 Location of Blade Removals...242

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Table 6.39 Wear Recorded on Blade Core Butts....243
Table 6.40 Preparation of Core Back....244
Table 6.41 Shape of Core Back....245
Table 6.42 Preparation of Core Bottom....245
Table 6.43 Order of Preparation....246
Table 6.44 Flaws in Core at Time of Discard....247
Table 6.45 "Other" Raw Material....251
Table 6.46 Raw Material and Dataclass by Site....251
Table 6.47 Dataclass by Raw Material at Gilund and Bagor....252
Table 6.48 Geometric Tools by Raw Material....254
Table 6.49 Description of Cherts....256-7
Table 6.50 Distribution of Chert Types by Site....258
Table 6.51 Distribution of Raw Material by Region of Source....259
Table 6.52 Cortical Evidence of Chert and Chalcedony Procurement from the River....262

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List of Figures

Figure 1.1 Excavated Sites of the Mewar Plain..12
Figure 2.1 Ahar-Banas and Surrounding Cultural Complexes. 30
Figure 6.1 Location of Raw Material Sources identified through Survey..................171
Figure 6.2 Handaxe from Semara B, Collection Unit 16....................................186
Figure 6.3 Cluster of Chalcedony boulders at Semara B....................................186
Figure 6.4 Quartz outcrop across the river from Bagor.....................................187
Figure 6.5 Chatrikhera VI, Quartz outcrop..187
Figure 6.6 Nathdwara Hill with Banas River in background................................188
Figure 6.7 Blade Core of Bhagwanpura Black Chert at Bhagwanpura.....................188
Figure 6.8 Trenches at Gilund. 190
Figure 6.9 Workers Screening at Gilund..191
Figure 6.10 Gilund Trenches with Lithics Included in the Study...........................197
Figure 6.11 Dataclass by Site...206
Figure 6.12 Scatterplot of Complete Blade Cores: Length versus Width...................219
Figure 6.13 Scatterplot of Complete Blades: Length versus Width........................219
Figure 6.14 Scatterplot of Complete Blades: Length versus Thickness....................220
Figure 6.15 Scatterplot of Complete Flakes: Length versus Width........................220
Figure 6.16 Scatterplot of Complete Flakes: Length versus Thickness....................221
Figure 6.17 Boxplot of Core Length, Width and Thickness by Raw Material and Site..221
Figure 6.18 Boxplot of Complete Flake Length, Width and Thickness by Raw Material and Site..222
Figure 6.19 Boxplot of Complete Blade Length, Width and Thickness by Raw Material and Site..222
Figure 6.20 Gilund 5400023 Core-on-Flake with Burin-like Initiation.....................239
Figure 6.21 Types of Core Backs: Elongated X, X, Square, Y.............................244
Figure 6.22 Raw Material by Dataclass at Gilund and Bagor...............................253
Figure 6.23 Distribution of Raw Material Sources at Gilund and Bagor...................260
Figure 6.24 Bagor Semara Red Chert Complete Flakes with Non-river-rolled Cortex, Lot 1005..263
Figure 6.25 Bagor Flakes with Cortex, Lot 1005...263

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Chapter 1. Introduction

Introduction

This dissertation examines the relationship between two contemporaneous archaeological sites on the Mewar Plain in southeastern Rajasthan: Gilund, a permanent settlement, and Bagor, a temporary camp. In the third to second millennium BC, the Mewar Plain was inhabited by a diverse range of communities who engaged in a spectrum of mobility and subsistence strategies. Gilund and Bagor, located approximately 30 km apart, in many ways represent two different points on these spectrums. Gilund was occupied by settled farmers and artisans who practiced occasional hunting and gathering, while Bagor was occupied by an itinerant community that practiced hunting, gathering, and pastoralism. Although there are many differences between these sites both relied heavily on lithic technology which is the focus of this study.

Previous research has indicated that both Gilund and Bagor participated in local and long distance exchange relationships, as did other sites of the Mewar Plain (Misra 1970, 1973; Shinde and Possehl 2005a). Some artifacts found in the initial excavations at Bagor, including pottery, beads, and three copper arrowheads (Misra 1970, 1973, 1982), were likely procured from permanent settlements in the region. However, the exact nature of this relationship has not been well defined. Thus, interaction between large and small sites with differing mobility and subsistence strategies warrants further exploration. Were the objects at Bagor acquired through anonymous and passing trade, or do they

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materially represent deeper relationships? Was regional interaction between the diverse groups of the Mewar Plain circumstantial, incidental, and sporadic? Or, do the objects at Bagor represent long-term relationships and shared histories between mobile and settled peoples in this region?

The new excavations at Gilund (Shinde and Possehl 2005a, b) and Bagor (re-excavated in 2001, but not yet published) provided an opportunity to re-examine regional interactions and relationships in the third and second millennium BC. In order to pursue this subject, focus was placed on lithics, the only class of artifacts that was plentiful at both sites. Through the analysis of nearly 35,000 lithic artifacts, it was possible to outline the technological practices and strategies employed at both sites. Three avenues of research were pursued in order to establish the potential relationship between Gilund and Bagor. First, the extant to which the inhabitants of the two sites shared overlapping material landscapes was investigated. Second, the extant to which their daily technology practices overlapped was examined. Finally, evidence for knowledge sharing was sought through the identification of skill sets that may have been held in common.

The first research path, identifying potential stone sources, was proposed because the inhabitants of Bagor were presumed to be more mobile than those of Gilund, and were thought to maintain separate cultural affiliations. As a result, it was not clear whether the inhabitants of the two sites shared an overlapping sense of landscape, or whether they operated in separate relational and geophysical spheres. Landscape is determined in part by the spaces and places in which daily and seasonal activities occur as well as specific places that are visited periodically for purposes such as social or religious obligations, and places that are known through shared information or shared

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objects. When communities share a landscape, this implies not just knowledge of each other, but also a shared knowledge of material sources, ritual places, other inhabitants, and places where historical events occurred. As a result, landscapes become more than spaces of shared interaction (Gosden 1989), but also spaces of shared meaning (Tilley 1994) and memory (Schama 1995). This study mainly uses a settlement ecology approach to landscape (Anscheutz, et al. 2001) and focuses on the physical locations and perimeters of actively used raw material sources as a way to map the landscapes of Gilund and Bagor. In order to gage the extant to which the material landscapes of Gilund and Bagor overlapped, an attempt was made to identify the stone raw material sources for both sites through a targeted raw material survey. Potential sources in the region were identified on geological maps with the assistance of local geologists and then field-checked for suitable material and evidence of lithic manufacture. The raw material samples from these sources were then compared to the raw material in the lithic assemblages of both Gilund and Bagor.

In addition to landscape, technological practices at both sites were examined. Practices such as mobility, subsistence, craft production, and other daily or regular activities all influence the makeup of lithic assemblages. Lithic production is influenced by these factors because technology is culturally embedded (Lemonnier 1992; Pfaffenberger 1992), and intersects with cultural practices (Dobres 2001). That is, technology intertwines with all activities that are undertaken on a regular basis including subsistence activities (tending fields, hunting, harvesting cereals) as well as other activities like craft production and household tasks such as cooking and preparing clothing. A full typological and attribute analysis of the collections was undertaken in

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order to identify similarity or variation between the lithic assemblages and thus to help discern overlap in technological practices.

Finally, the collections of Gilund and Bagor were examined for evidence of cross-over skills or techniques that may have been shared. Like other technologies, many aspects of lithic production are complex skills that must be taught and learned. Communities frequently share a common perception about proper techniques (Weissner 1984). Technological knowledge is sometimes shared even when other cultural features are not. For example, Wright has shown that technological skills were often shared among potters of the Indo-Iranian borderlands, even when unique stylistic flourishes were regularly employed (1989). Similarly, Stark et al. (1998) found that the study of technology can help to identify social interaction between two areas that appear to be culturally distinct. As cores leave multiple signatures that indicate the methods used in production, they became the focus of this part of the study. Specific core production techniques utilized at Gilund and Bagor were identified through the analysis of core typologies and attributes. The findings were contextualized through an examination of select reports on lithic collections from other regions in South Asia.

These three analytical pathways—identifying material landscapes, technological practices, and shared skill sets—together comprise a method for envisioning connections between two communities that superficially appear to be very distinct. While the presence of imported pottery, beads, and copper implements may indicate trade or exchange with other sites of the region, it cannot explain all aspects of those interactions. It is argued here that a full analysis of lithic technology can help point to deeper connections and shared histories.

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Variation in Mobility and Economic Strategies

Ethnographic Models

Archaeologists have frequently drawn from ethnographies and ethnoarchaeological studies in order to help analyze the archaeological record and describe the past. Although there are difficulties in using ethnographic analogy (Yellen and Harpending 1972), the practice has been a productive one for those who understand both the limits and potentials of this form of research (Wylie 2002).

Ethnographic research on hunter-gatherers has demonstrated that there is no one-to-one correlation between mobility and subsistence practices. Mobility and sedentism occur along a spectrum (Kelly 1992). In addition, subsistence strategies are usually more complex than the shorthand designation of "hunting-gathering" or "agriculture" may indicate. Communities who are known as hunter-gatherers may engage in other economic activities like tending goats or cultivating crops on a small scale. Agriculturalists may periodically hunt or forage in order to supplement what could potentially otherwise be a monotonous diet of a few farmed crops. Subsistence of any form should also be seen as one aspect of a larger economy that may incorporate craft production, specialized services, trade and exchange, and the payment of tribute or tax.

Just as conceptions of mobility strategies and subsistence practices have been reframed in recent years, so has the traditional depiction of hunter-gatherers as social isolates. For example, Fox refers to hunter-gatherer-traders as "professional primitives" because they forage for products that they then exchange (Fox 1969). Helms (1993) suggests that nomadic and mobile people who engage in trade are like skilled artisans

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because they are "specialists of distance." In South and Southeast Asia, there are numerous ethnographic examples of hunter-gatherers who trade forest products like honey and peppers for farm products like food grains and crafts which are produced by villagers (Fox 1969; Gordon 1984; Griffin 1985; Headland and Reid 1989; Hoffman 1984; Hooja 1994; Hutterer 1977b). Ethnographic research suggests that the relationship between hunter-gatherer and farmers are frequently deeper than anonymous and passing trade.

Ethnographic research on pastoralists has similarly demonstrated great variation in mobility and subsistence practices (Dyson-Hudson and Dyson-Hudson 1980). Mobility may range from full nomadism (Barth 1961), to seasonal transhumance (Kavoori 1999) to periodic transhumance when climate conditions are unfavorable (Fisher 1997). Similarly, there is great variation in broad economic strategies; many pastoralists also grow crops, produce crafts, and do wage labor. For example, Salzman refers to the practices of the Baluchistan pastoralists as "multi-resource nomadism" (Salzman 1972). Many pastoralists are well integrated into their home villages although they only live there for part of the year. Their seasonal routines, however, ensure that they remain a distinct community from those who reside in villages permanently.

The South Asian ethnographic record on hunter-gatherers has traditionally been strong and a rich resource for archaeologists. However, in recent years a number of ethnographic studies on pastoralists have been produced and can potentially provide alternative models for sites like Bagor. By reviewing this new literature it is possible to recontextualizing the relationship between sites like Gilund and Bagor and to offer

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alternative explanations for the types of interactions that occurred between similar sites in the Mewar Plain.

Exchange as Interaction in Archaeology

There are many types of interactions between mobile communities—such as those who hunt and gather or tend flocks—and settled communities with more varied economic strategies that include tending fields and flocks as well as practicing artisanal or other full-time activities and services (Denbow 1984; Junker 2002; Morrison 2002a, b; Peterson 1978; Sinha 1972). Similarly, there are many ways that archaeologists imagine social and economic interactions of the deep past. Archaeological evidence for exchange is most commonly identified in the presence of non-local artifacts and raw materials. However, the mere presence of non-local materials does not always provide information on other aspects of long-term exchange relationships and shared economic histories. The exchange of goods does not occur without the exchange of information (Renfrew 1975; Wright 1989). Nor does it occur in a vacuum of other social processes (Earle 1982; Ericson 1977; Hodder 1982; Lamberg-Karlovsky and Sabloff 1975). Frequently, ancient exchange emphasized the procurement of rare and exotic items (Dalton 1975), the cementing of social bonds (Hunt 2002; Malinowski 1961[1922]; Mauss 1990 [1925]), or the recognition of political and economic obligations (Polanyi, et al. 1957; Sahlins 1972; Weiner 1992). Through exchange some individuals or families could acquire great wealth or power (Weiner 1992). Long-distance goods were acquired through a variety of methods including raid and plunder, tribute or taxes, gift exchange (reciprocity) between rulers, commercial or market trade, and politically administered trade (Dalton 1975:104-9). Exchange usually has a symbolic or ideological quality which affects the value and

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meaning of the objects exchanged (DeMarrais, et al. 1996; Hodder 1982; Keane 1994). In addition to exchange, other types of material transfers leave archaeologically visible remains in the form of foreign artifacts or artifacts linked to other sites and regions. These include sharing, the division of domestic assets, and endowment transfers, all of which occur within families or within communities that recognize strong ties (Hunt 2002). In sum, the transfer of material between communities as evidenced in the archaeological record may indicate any one of multiple potential relationships between the inhabitants.

Archaeological Evidence

Just as ethnographic and historical evidence point to the existence of various forms of exchange relationships between those who practice varied mobility and subsistence regimes, so does the archaeological record (Junker 2002; Morrison 2002a, c; Possehl 2002a; Spielmann 1991; Spielmann and Eder 1994). In India, village produced items such as copper spear heads, beads, and pottery have been found at temporary camps like those of Bagor as well as other sites like Langhnaj in Gujarat (Misra 1970; Possehl 2002a; Possehl and Kennedy 1979; Sankalia 1965:17-19). Langhnaj is located near the trading center of Lothal, a large Chalcolithic town that engaged in high levels of intraregional and interregional trade (Possehl 1976; Rao 1979). Just as a large number of foreign artifacts were found at Lothal, some were found at Langhnaj (IAR 1953-54a, 1963-64a; Karve-Corvinus and Kennedy 1964; Sankalia 1965). Possehl has argued that the mobility of the hunter-gatherers of Langhnaj placed them in a unique position where they could act as traders, bringing forest products into Lothal (Possehl 1974, 1976). He argues that "the Harappans and the Gujarati hunter/gatherers were involved in some kind

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of bilateral, balanced system of reciprocity" (Possehl 1992a:126). These ethnographic and archaeological studies have provided crucial information for our understandings of economies and the relationship between communities in the ancient past.

The archaeological record provides the material evidence for connections between sites in the form of artifacts and raw materials that clearly came from "outside." Whether or not these materials were acquired through impersonal and passing trade, theft, or some other semi-anonymous and socially vacuous action, or perhaps as the expression of close ties, must still be investigated. Morrison notes that, "Although the movement of artifacts from urban contexts to locations used by more mobile peoples is easer to see than any reverse flow of goods, hunter-gatherers should not be viewed simply as the recipients of technological treats" (Morrison 2002c:30). The study of lithics can solve both problems pinpointed in Morrison's observation. First, it balances the data because lithics are found in both contexts, not just that of hunter-gatherers. Second, technological studies can enhance our understanding of past societies by demonstrating to what extant technological knowledge was shared.

The Mewar Plain

It is clear that the Mewar Plain in southeastern Rajasthan was occupied by a large number of different types and sizes of sites after the fifth millennium BC. Hundreds of sites dated to the third millennium BC have been found through survey of this region (DasGupta 2006; Hooja 1988; Misra 1967). The sites range in size from massive, multi-mound habitations to tiny microlith scatters of a few meters in extent. In many ways, Gilund and Bagor are representative of large and small sites in the region. A full description of these sites is presented in Chapter 2.

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This region was originally inhabited in the Pleistocene by mobile hunter-gatherers, some of whom presumably settled into the first villages and began growing crops at approximately 3000 BC, while others maintained a more mobile lifestyle. Subsistence and mobility strategies shifted at this point in time, as did economic networks. That is, the region was a patchwork quilt of settled and mobile communities with varying subsistence strategies who lived side-by-side and co-existed through economic and social relationships. Using ethnographic analogy, most researchers have concluded that the inhabitants of Bagor were ethnically distinct from the farming villages that are collectively known as the Ahar-Banas Cultural Complex. The definition of the Ahar-Banas Cultural Complex is based on presence of the distinctive Ahar Black and Red Ware pottery and formal similarities among animal figurines, beads, and other small artifacts. Bagor and Gilund are considered to be not only separated by practices of mobility and subsistence, but actually ethnically distinct and minimally linked through occasional trade or exchange.

While ethnographic work has substantially elaborated our understanding of contemporary practices of affiliation and interaction between diverse groups in the region (Dutt 2004; Hooja 1994; Misra 1990), archaeological work has lagged. Excavations at Bagor and five other Ahar-Banas sites have revealed evidence for local and long-distance trade and exchange (Gogte 1996; Kumar 1984-85; Misra 1973; Misra, et al. 1993; Possehl, et al. 2004; Shinde and Possehl 2005a). While ties between permanent settlements of the Ahar-Banas are presumed to be strong and self-evident, the exchange between inhabitants of temporary camps and permanent settlements has been less well defined. Two studies have situated Bagor within the broader Mewar Plain (Hooja 1988;

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Khanna 1988), and have determined that Bagor was well integrated into the regional context. However, it was not possible to know whether relationships between Bagor and other sites were defined by exchange—incidental, in passing, and anonymous—or whether they represented the material aspects of deeper, long-term, intimate relationships. It is likely that any exchange between hunter-gather/pastoralists and farmers contained a large social and cultural component.

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Figure1.1 Excavated Sites of the Mewar Plain

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Gilund

Gilund, a two mound site that is approximately 25 ha in size, was first excavated by B.B. Lal (IAR 1957-58a:45; 1959-60a:41-46). In 1999 a joint team from the University of Pennsylvania and Deccan College undertook a new five-season excavation of the site (Shinde and Possehl 2005a, b, in press). It appears that the mound was occupied from 3000 BC through 1700 BC and later. The excavators divide the earliest periods into three phases:

Late Ahar-Banas	2000-1700 BC
Middle Ahar-Banas	2500-2000 BC
Early Ahar-Banas	3000-2500 BC

Excavations uncovered multiple house structures, a large communal mudbrick building comprised of parallel walls, multiple pyrotechnic workshops and several midden areas. Preliminary faunal and ethnobotanical analyses indicates that the inhabitants practiced a mixed agro-pastoral subsistence that they supplemented with wild plants and wild animals such as fish, turtles, and nilgai or antelope. The preliminary pottery analysis indicates that Gilund produced and consumed the complete range of Ahar-Banas wares. Stone, terracotta, and steatite beads were found, as were terracotta animal figurines, shell and terracotta bangles, spindle whorls, ear spools, geometric stamp seals, and copper artifact fragments.

Bagor

The site of Bagor, although in the same region, has frequently been treated quite differently from the rest of the Ahar-Banas sites. It has often been referred to as "Mesolithic" because it largely consists of a lithic scatter and the site was originally a

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temporary camp of hunter-gatherers who only later incorporated pastoralism into their subsistence regime. The site was first inhabited at 5500 BC, but was continuously used throughout the Chalcolithic and the middle layers of the site are contemporaneous with the Ahar Banas (Misra 1973, 1982).

Phase III	600 BC- 200 AD
Phase II	2800-600 BC
Phase I	5000-2800 BC

The site is located to the north of many Ahar-Banas sites, like Gilund, Ahar, Balathal, and Marmi, but it is south of Ojiyana (see Figure 1.1). Hundreds of similar lithic scatters have been identified throughout the region (Hooja 1988; Misra 1967), but Bagor is the only one of its kind that has been excavated and well published. The site lies on a fossilized sand dune on the banks of a recently dried up river and is very similar to dozens of other lithic scatters identified in the region. The site has no permanent architecture, and few artifacts other than bones and microliths were recovered. The original excavations did, however, find distinctive Ahar-Banas pottery and steatite beads which indicated contact with nearby Ahar-Banas sites and which presumably were acquired through trade and exchange (Misra 1970, 1973, 1982). In addition, a copper spearhead and a copper awl were found as were three copper arrowheads were found that Misra describes as strongly resembling copper arrowheads found in the Indus region. While five burials were recovered, only three are attributed to the time period that is contemporaneous with Gilund: one child and two adults (Kennedy 1982; Kumar 1970-73; Lukacs 1982; Misra 1972).

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Third and Second Millennium BC Interaction in the Mewar Plain

The exact nature of the relationship between Bagor and Gilund or between mobile and settled people of the Mewar Plain in the third and second millennium BC remains unclear. Sites like Gilund were the first farming villages in this region, and it would not be unusual to find that some communities never adopted agriculture. Archaeologists who work in the region usually use contemporary ethnographic parallels since mobile peoples still roam across Rajasthan and have long-term relationships with certain farmers and villagers. Ahar-Banas and Harappan artifacts found at Bagor indicate a shared history between these two sites, although the exact form of that connection has not yet been determined.

One of the difficulties in discerning this relationship has been identifying the contemporaneity of sites in the region. Frequently, microlithic scatters have been identified as "Mesolithic," implying incorrectly that they predate the sites of the Ahar-Banas which have been designated as "Chalcolithic." Separating the "microlithic" from the "Mesolithic" is a crucial aspect of understanding the relationship between sites in this region.

Rima Hooja (1988) argues that Ahar-Banas sites and many of lithic scatters of the region were contemporaneous but that the nature of their relationship is still unknown. Her report emphasizes the fact that microliths and Ahar-Banas lithics frequently co-occur and that some form of interaction – economic or otherwise – likely occurred between the inhabitants of sites called "Mesolithic," like Bagor, and contemporaneous sites of the Ahar-Banas, even though they are designated "Chalcolithic." However, she cautions that

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the evidence is insufficient to determine exchange patterns. It is suggested here that an analysis of technology can bridge this gap.

There has been a tendency to conceptually separate Gilund and Bagor into two separate worlds that occasionally met and interacted. While it is simple to say that Gilund was a settled agricultural village and Bagor was a camp of mobile hunter-gatherers or pastoralists, the picture is actually much more complicated. The former is a permanent settlement and the latter is a a more ephemeral settlement. Gilund consists of two large mounds filled with a great variety of artifacts and architecture; Bagor is small and appears to be a scatter of lithics on the surface of the ground. Gilund practiced agriculture, while Bagor seemingly did not (but see Kashyap 2006). The inhabitants of Gilund mostly kept domestic animals and consumed few wild animals, while Bagor originally consumed only wild animals, but later incorporated pastoralism into their subsistence regime. Gilund is seen as technologically sophisticated; the excavations found kilns and other evidence of high-temperature pyrotechnology. Bagor is seen as technologically backward because they made only stone tools and although they had copper tools and pottery, there is no evidence that they fabricated either item. Gilund produced crafts and had such an elaborate exchange system that it was regulated with stamp seals (Possehl, et al. 2004); Bagor produced nothing of note and has only a few artifacts that came from other sites. In sum, it is easy to dichotomize these sites and to separate them from each other. Clearly, Gilund has much more in common with the other excavated sites of the Ahar-Banas cultural complex: Ahar, Balathal, Marmi, and Ojiyana since they are all large mounds of agro-pastoral villages with architecture (some of which is communal), and evidence of craft production and exchange. Most

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importantly, they all share a similar ceramic style including Ahar-Banas Black and Red Ware, as well as some other artifacts like steatite beads and animal figurines. Bagor, on the other hand, shares a great deal in common with other lithic scatters found throughout southeast Rajasthan: all are mostly located on fossilized sand dunes in close proximity to a river or tributary. In addition, these camps share a blade and microlith technology, some hammerstones and groundstones, and a few pieces of Ahar-Banas pottery.

However, considering these two sites as representative of two halves of a dichotomy is not very analytically useful, nor, archaeologically accurate. Instead, the exclusion of Bagor from frameworks that examine the economies of the Ahar-Banas Cultural Complex, is an omission that should be rectified through the creation of a single framework for the Mewar Plain that recognizes a multiplicity of mobility and subsistence strategies and the interaction of numerous communities within a diverse society.

This research further explores the relationship between Bagor and the other sites in the region by incorporating them into a single framework. In South Asia, these exchange relationships are largely based on artifacts found in excavations of the mobile camps. In this analysis the stone tools of Gilund and Bagor are compared with the intent of finding the similarities and differences between multiple aspects of the collections.

Lithics in the Mewar Plain

Just as there is variation in copper production, procurement, and use at all the sites of the Mewar Plain, there seems to be great variation in the way that each site procured, produced, and used lithics. At Ahar, a large farming village, a number of lithics were found, mostly of the locally available quartz (Sankalia, et al. 1969:15). Like many archaeologists who have worked in metal using societies, Sankalia dismissed the idea that

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lithics were important to the economy. Instead, he suggested that they were produced by the inhabitants of the lowest levels and were merely intrusive in all Chalcolithic layers. Since most of the lithics were made of poor quality quartz, it is not surprising that their importance was overlooked. At Balathal, a small village with a massive stone cattle pen, there were very few lithics, although it was occupied in the Late Ahar-Banas (Misra 1997). Marmi, the largest of all the Ahar-Banas villages, has the largest density of surface lithics, and a higher ratio of chert to quartz (personal observation). The published lithic reports from these excavations do not allow any further detailed observation, but it does seem that each community shared similar lithic technologies, but very different lithic practices.

The excavators at Ahar focused on creating ceramic sequences and identifying the origins of the people who lived there. As was common for many excavations of the time, lithics received less attention, and were only briefly described. The abundant presence of lithics at Gilund was surprising since the other extensively excavated sites in the region (Ahar and Balathal) evidenced few lithics. Prior to the Gilund excavations, it was thought that the inhabitants of this region did not rely on lithics. Because copper-bronze was readily available and the inhabitants were classified as farmers, it was thought that they did not need lithic tools to accomplish their subsistence goals.

The study undertaken here represents an opportunity to examine aspects of lithic technology in the region previously undocumented such as raw material distribution, multiple attributes, and core production techniques. These studies provide insight into the landscape, daily practices, and skill sets of the people of the Mewar Plain.

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Plan of the Work:

In the following chapters the available theoretical, methodological, and regional literature will be reviewed. This will be followed by a presentation of original research undertaken in India from 2004 to 2006 and a discussion of the results.

Summary of Chapter 2: The Region

This chapter provides a background on the literature pertaining to the region of research: southeastern Rajasthan. A survey of the geological formations illustrates the range and location of available stone raw material. Previous archaeological surveys and excavations in the region are also discussed in order to elucidate the regional occupation patterns from the sixth millennium BC through the first millennium BC. A short discussion on the nature of the Ahar-Banas Cultural Complex and its relationship with neighbors both near and far frames the discussion of the relationship between Gilund and Bagor. These two sites are then described in detail in order to provide background for the following lithic study. A description of ancient and modern mobile groups that have occupied the region completes the chapter.

Summary of Chapter 3: Hunters, Pastoralists, Farmers

In 3000 BC, southeastern Rajasthan was inhabited by a patchwork mosaic of communities with diverse mobility practices as well as a variety of subsistence strategies that ranged from hunting and gathering to agro-pastoralism. This chapter reviews the ethnographic and archaeological literature on those who practice these diverse subsistence strategies. Particular attention is paid to various mobility strategies including the pastoral practice of transhumance. In addition, the chapter discusses the relationships

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between different communities and the role of itinerant people in regional and long-distance trade and exchange. A review of the literature on trade and exchange demonstrates that economic networks usually represent deeper and more long-term relationships than initially supposed. The chapter reviews the hunter-gatherer ethnographies that are typically used as models as well as ethnographies of pastoralists that have drawn less attention among archaeologists.

Summary of Chapter 4: Lithics

Prior to the analysis undertaken in this project, it was expected that the lithic assemblages of Gilund and Bagor would be appreciably distinct. The reasons for this expectation will be explored in this chapter. The ways that lithic analysts approach mobility, subsistence, and non-lithic craft production will be examined. In addition, the way that raw material influences lithic assemblages will be examined. In addition to exploring the processes that create diverse lithic assemblages, this chapter will also discuss some of the social processes that create convergent lithic assemblages. Core production and morphology will be closely examined. Finally, a brief review of anthropological approaches to technology concludes the chapter.

Summary of Chapter 5: Lithics in South Asia

In order to provide a broader context within which to situate the lithic assemblages at Bagor and Gilund, this chapter will provide an overview of chronological and regional variation in lithic technology across South Asia. In addition, the notion of evolution of Indian lithics from the early Holocene through the first millennium BC will be explored. Finally, this chapter will examine the ways that lithics have been studied in

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India in order to situate the methodology employed in this dissertation. Special attention will be paid to studies of core technology and core typologies.

Summary of Chapter 6: Method and Data

This chapter is divided into five parts. The chapter first describes the methods used to create the lithic collections. Selection of the data set is discussed along with analytical methods. This is followed by a discussion of the raw material survey undertaken in order to locate the potential sources of Gilund and Bagor lithics. The chapter next presents a general overview of the lithic assemblages at Gilund and Bagor for the time period when both sites were simultaneously occupied. The fourth section focuses on a detailed analysis of the cores from both sites. Finally, the analysis of raw material samples and artifacts is presented and discussed.

Summary of Chapter 7: Discussion and Conclusion

This chapter summarizes and synthesizes the preceding chapters. Those factors that influenced the lithic assemblages are discussed and the resulting implications of the findings are presented. Avenues for further research will also be suggested. The initial questions regarding the relationship between Gilund and Bagor will be discussed, along with some final thoughts on overlapping landscapes, daily practices, and technological skill sets.

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Chapter 2: The Region—Geology and Occupation

Gilund and Bagor are located in the southeastern part of the modern Indian state of Rajasthan, in a geographical formation known as the Mewar Plain. The region has considerable evidence for a long term history of occupation from the Middle Paleolithic through the present. This chapter will review the geography and climate history of the region as well as the history of early to mid-Holocene occupations in the Mewar Plain and surrounding areas. A brief summary of the surveys and excavations undertaken in the region will be presented. This will be followed by a description of the sites of the Ahar-Banas Cultural Complex with a focus on Gilund and Bagor.

Geography

Rajasthan is famous for the Thar Desert in the western part of the state; an area where sand dunes follow sand dunes and nomadic peoples herd camels between far-flung oasis cities. The Mewar Plain, home to the sites of the Ahar-Banas Cultural Complex, is located in southeastern Rajasthan, on the eastern side of the Aravalli mountain range, in an area that is semi-arid and cultivable. The area is geologically quite old, as it was formed one billion years ago (Roy and Jakhar 2002). Most of the area lies approximately at sea level, although intermittent hills can be as much as 1000 m higher. The plain is laced with rivers and tributaries that flow to the northeast.

The Mewar Plain, sometimes called the Eastern Plains or the Banas-Berach basin, is an alluvial plain; relatively flat, but slopes gently to the north/northeast (Roy and Jakhar 2002: 12). Intermittent hills and mesas occur at various intervals. Each of these

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formations is distinctive and from most points on the plains it is possible to see multiple hills, which may have served as way markers to travelers in the past. Most of these hills run north-south and are comprised of granites, schist and dolomitic rocks. While the tops of these hills provide excellent unimpeded views of the surrounding area in all directions, most could not be occupied since they are only a few meters wide at the apex. In fact, most hill-tops visited in the course of this research project showed no signs of ancient human activity; although contemporary activity was visible in the form of schoolchildren passing time.

The Aravalli mountain chain runs roughly northwest-southeast on the western edge of the plain. The mountains are comprised of Proterozoic rocks (2500 to 800 million years old) on top of Archaean rocks which are roughly one billion years old (Roy and Jakhar 2002). The Aravallis lie between fault lines and were created through uplift activity. The mountains and hills are generally comprised of gently sloping rises and falls; abrupt cliffs and steep rises are rarely seen. The mountain range is made of the Mewar Gneiss Complex (MGC), formerly known as the Banded Gneissic Complex I (BGCI), and contains gneiss, granite, and quartzite, among other rocks and minerals. The Aravallis in the Ahar-Banas region (near the site of Ahar) contain a very large and well-known zinc deposit that was used in ancient times and is actively mined today. The Aravallis to the north of this area are known as the Khetri Copper Belt and contain copper deposits that were also mined in the deep past as well as today (Agrawala 1984; Chakrabarti and Lahiri 1996; Kenoyer and Miller 1999). The Mewar plain is bounded on the eastside by the Vindhyan supercomplex, a group of hills that run roughly parallel to the Aravallis, approximately southwest to northeast.

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The Mewar plain mainly contains a very sandy alluvial soil that lacks many of the nutrients necessary for productive farming. In addition, many fields are quite rocky and contain quartz deposits, which also hinder attempts at farming. Although contemporary farmers continue to expand their fields, the region is probably best suited for grazing and foraging.

In the southern part of the area, the Deccan Plateau rises from the south to meet the Mewar plain. The Deccan Plateau is a massive geological formation that sits in the center of the country. It was formed through ancient volcanic activity and is comprised largely of basalt and dark basaltic soils, commonly known as "black cotton soil." Black cotton soil is rich in nutrients and excellent for farming crops. In the area where it meets the Mewar Plain, the black cotton soil is patchy; therefore it is present in some fields while absent in others. As a result, some fields are more agriculturally productive than others and the sale and distribution of cartloads of the soil to farmers with poor fields is quite common (personal observation). In the past, the presence or absence of this soil may have affected the location of early farming villages.

The region is criss-crossed by a network of rivers and tributaries. The major rivers are the Kothari, the Banas and the Berach (which flows into the Chambal), which originate in the Aravallis. The subcontinent's watershed line is located in the Aravalli Mountains. As a result, all of the rivers in this region flow in a generally eastern direction into the Bay of Bengal on the eastern part of the Indian subcontinent. In the past these rivers only flowed for part of the year, and remained completely dry in the hot season just before the monsoon arrived. In recent years, the monsoons have been

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particularly scant and as a result most of the local rivers dried up in the early 1990's[1]. The region receives approximately 660 mm of rain each year during the southwestern monsoon that passes through the region sometime between June and October. The Aravallis act as a block to the monsoons, holding the rains back from the areas immediately north and west; they cause the Thar Desert to be so arid. The monsoon rains can be somewhat irregular and some years they bypass the region entirely, which greatly influences the predictability and productivity of farming in the region. Regardless of the strength of the monsoons, the Chambal River (and its tributary the Berach) still holds water throughout the entire year. The seasonal change in river water levels doubtless had multiple affects on early farming villages including implications for agricultural patterns, river travel and trade, and the consumption of fish and other water plants and animals.

Human occupation over the past several millennia has changed the nature of Rajasthani vegetation and animals. At the present time the area is mostly under cultivation, although there are patches that remain as rocky outcrops, scrubby forest or grassland. These areas contain many different types of trees including bor trees, which produce an edible fruit. In their contemporary ethnography of a Rajasthan village, Grozdins Gold and Gujar (2002) list 24 non-agricultural plants that the villagers discuss as part of their material culture. Desired trees like teak and dozens of other plants were once plentiful in this region, but can no longer be found (Kavoori 1999:25). In western Rajasthan 61 kinds of grasses, 32 shrubs and 13 types of trees are regularly used for pasture and fodder (Kavoori 1999:24). In the Mewar plain, overgrazing by cattle has stripped many areas while over-foraging for sheep/goats has contributed to a major beetle

[1] Increased population and tourism, the introduction of bore-wells, and expanding agriculture, also has increased regional water usage, lowered the water table, and drained the lakes that acted as sources for many of these rivers.

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infestation that is killing the acacia trees. Construction and road building practices encourage soil borrowing and piling, so that very little of the land has been left undisturbed in some way. Almost every acre of the region has been dug, borrowed, built-on, or tilled.

Similarly, the wild animals that remain in the region today bear little resemblance to those that lived and prowled there several millennia ago. Human hunting and deforestation along with the increase of agricultural land has dramatically changed the habitat of wild animals. In the region today nilgai are still common along with jackal, deer, mongoose, rabbits, peacocks, and monkeys. In addition, wild boar, antelope, gaur, and black buck used to regularly roam the area in the past. Threats to humans include cobras, and in the past, tigers, and lions as well. During the monsoon flocks of birds swarm the area to take advantage of the numerous pools that suddenly appear.

Climate

Several climate studies on ancient Rajasthan have been conducted. Many of these studies agree that at some point in the past Rajasthan has seen wetter conditions than the present climate. However, they disagree on when these conditions persisted. Singh et al (1974) outline five phases of climate change in the Holocene. They state that prior to the Holocene lack of rainfall caused the dunes to form in the Thar Desert. Moist conditions through most of the Holocene declined around 3500-1500 BP when the lakes began to dry. The time period from 1200 BP onward had similar conditions to the present. Agrawal and Sood (1993) argue that the late Pleistocene was wetter than the early Holocene. Moist conditions prevailed at 6,000-5,000 BP but by 3,500 BP the climate became more arid. Wasson et al (1983) also found that the sand dunes of the Thar desert

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stabilized in the middle Holocene due to wetter conditions. These studies were supported by later research on salinity and sediment deposition in Lake Didwana that showed increased rainfall around 6,000 BP as well as a drier period due to an unreliable monsoon around 4,000 BP (Wasson, et al. 1984). Possehl (1996) and Misra (1984) dispute the climate data as well as the concept of abandonment of the Indus due to climate. More recent work by Schuldenrein et al (2007) demonstrate that the mid-Holocene (roughly 5,000 BP) was somewhat drier than the late Holocene and that fluctuating monsoons occurred at the time of the Mature Indus.

Paleolithic Occupations

The Mewar Plain was first inhabited during the Middle Paleolithic. Paleolithic implements have been found in the Berach Basin (Kumar 1963-64; Misra 1967, 1968), near Chitorgarh (Banerji; IAR 1953-54b, 1954-55b, 1955-56c, 1956-57a, 1957-58b, c, 1958-59, 1959-60b, 1960-61, 1961-2, 1962-63a, 1963-64b, 1982-83c), and near the border of Madhya Pradesh (IAR 1963-64c, 1981-82d, 1984-85d, e). Middle Paleolithic sites have been found in other areas as well, including western Rajasthan (Allchin 1980; IAR 1976-77a, 1977-78a, b, 1978-79a, 1980-81, 1981-82a, b, 1982-83a, b, d, 1983-84a, c, 1984-85a, 1989-90) and northern Rajasthan (Allchin and Goudie 1973; Dikshit 1966-68; IAR 1962-63b, 1981-82f, 1985-86, 1987-88b).

Mesolithic Occupations

Although the first occupations of the Mewar Plain occurred in the Pleistocene, the population increased in the early Holocene (Misra 2002a). Hundreds of microlithic sites have been located in Rajasthan through survey (Hooja 1988; IAR 1954-55b, 1955-56b,

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1956-57a, b, 1957-58a, 1958-59, 1959-60b, c, 1960-61, 1962-63a, 1963-64b, 1964-65b, 1965-66a, b, 1967-68d, e, f, 1971-72, 1976-77a, b, 1977-78a, 1978-79a, b, 1981-82d, e, 1982-83a, c, 1984-85b, c, 1988-89b, 1991-92, 1998-99; Misra 1967). Many of these sites have been classified as Mesolithic and two have been excavated: Bagor (discussed below) and Tilwara (IAR 1967-68c; Lukacs, et al. 1982; Misra 1971a, b, 1982). During survey, Mesolithic sites are frequently identified using the presence of microliths. However, these artifacts were manufactured in South Asia from approximately 20,000 BP through the mid-first millennium BC and possibly later. Therefore, the presence or absence of microliths is a poor indicator of chronology and the Mesolithic status of many sites can only be confirmed through excavation. The Mesolithic is a problematic nomenclature for South Asia (Possehl and Rissman 1992); a full discussion the "Mesolithic" in South Asia is presented in Chapter 5.

Prehistoric Occupations in Rajasthan and Surrounding Areas

The regions around the Mewar Plain were occupied contemporaneously with the Ahar-Banas Cultural Complex. Hooja and Kumar's (1997) study of third and second millennium BC Rajasthan, divides the region into three areas: the Ahar-Banas, Pre-Harappan and Harappan sites along the Ghaggar River to the north; and the Ganeshwar-Jodhpura Complex in central and northeastern Rajasthan (Rizvi 2007). Similarly, Possehl (Possehl 1992b, 1997; 2002b:7) offers a framework that reaches beyond Rajasthan and divides Northwestern India and Pakistan into multiple domains of the Indus and other cultural entities (see Figure 2.1). This framework includes the Ganeshwar-Jodhpura Cultural Complex to the north of the Ahar-Banas and the Eastern Domain to the north of the GJCC. The Cholistan Domain is the to the north of the Ahar-

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Banas, the Sindhi Domain to the west and southwest, the Anarta Chalcolithic to the south and the Sorath Domain of the Indus to the southwest of the Anarta Chalcolithic. In addition, the Kayatha Culture and the Deccan Chalcolithic are located to the east and southeast of the Ahar-Banas Cultural Complex. These regions are defined according to sets of material culture traits, with special emphasis on pottery typologies and attributes. A brief description of regions immediately adjacent to the Ahar-Banas Cultural Complex is presented here.

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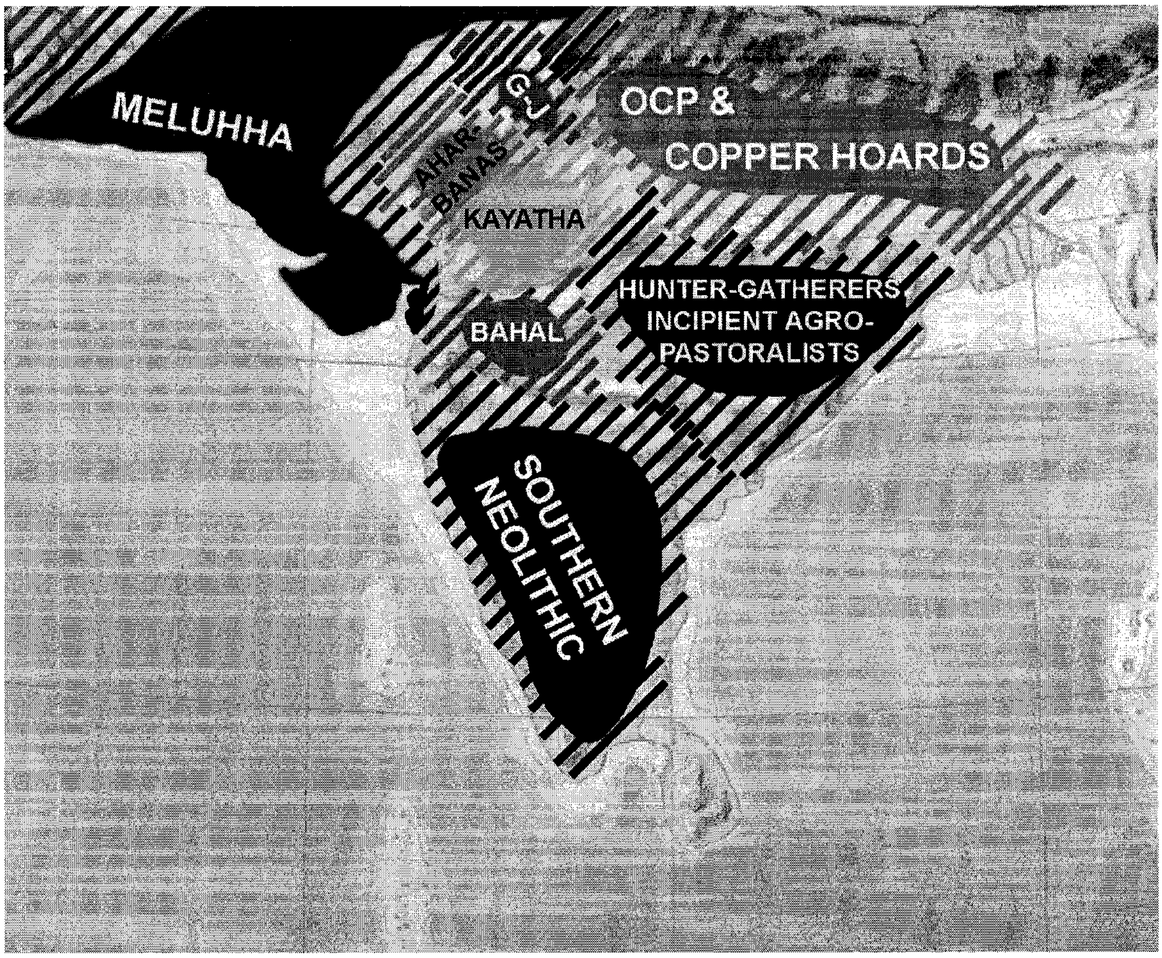

Figure 2.1 Ahar-Banas and Surrounding Cultural Complexes.
"Meluhha" refers to the Indus Civilization. "G-J" refers to the Ganeshwar-Jodhpura Cultural Complex. "OCP" refers to Ochre-Colored Pottery. Map courtesy of Gregory L. Possehl.

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Ganeshwar-Jodhpura

The Ganeshwar-Jodhpura Cultural Complex (GJCC) is located to the north of the Ahar-Banas Cultural Complex, near the Aravalli Mountains. Centered on the two type-sites of Ganeshwar and Jodhpura, the GJCC consisted of dozens of sites of various sizes. First identified by Agrawala and Kumar through their survey and excavation of the type sites (IAR 1981-82c, 1983-84b, 1987-88a, 1988-89a; Kumar 1977), the GJCC has been recently resurveyed with positive results (Rizvi 2007). The new chronology proposes that the GJCC lasted from 2900-1800 BC, which is roughly contemporaneous with all three phases of the Ahar-Banas Cultural Complex (Rizvi 2007:72).

The GJCC is located near the Khetri Copper Belt which has long been thought to have been the source for much of the Indus copper. Because of their location, these sites may have played a critical role in the procurement and distribution of copper for the Indus (Agrawala 1984; Chakrabarti and Lahiri 1996; Kenoyer and Miller 1999). Kumar suggests that the 1200 copper objects found at Kalibangan came from the GJCC. The occupants of GJCC sites utilized Ochre Colored Pottery, unpainted Black and Red Ware, and Painted Grey Ware. For many years, the GJCC was conflated with the "Ochre Colored Pottery Culture," although the latter cultural complex is no longer accepted (Hooja and Kumar 1997). Bountiful copper artifacts include fishhooks, arrowheads, rods, celts, rings, bangles, and pins. Plentiful lithics also were found in the excavations and surveys. It was originally thought that the GJCC may have been comprised of a hunting and gathering community who procured copper during their annual movements (Agrawala and Kumar 1982; Hooja and Kumar 1997). Kumar argued that the abundant

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copper arrowheads found at the site (over 800) "suggests that the people of Ganeshwar, though had developed copper technology, were still in a hunting stage" (Kumar 1984-85:7).

Kayatha

The Kayatha culture is named for the type site of Kayatha, which sits on the Choti Kali Sindh tributary (Ansari and Dhavalikar 1973; IAR 1964-65a, 1967-68a; Wakankar 1969). The culture is divided into three time periods: Kayatha period (2450-2000 BC), Banas period (1950-1700 BC), and Malwa Period (1700-1400 BC) (Possehl and Rissman 1992:483). The middle, Banas period, is so-called because the ceramic assemblage is nearly identical to Ahar-Banas pottery (Possehl and Rissman 1992:482). A stash of long barrel carnelian beads and micro-steatite beads found at the site indicate exchange with Harappan sites.

Deccan Chalcolithic

The Deccan Chalcolithic is an umbrella term that refers to multiple time periods of the third and second millennium BC and regions located within the Deccan Plateau. The time periods that overlap with the Ahar-Banas Cultural Complex include the Savalda (2000-1900 BC) and the Post-urban Harappan (1800-1700 BC). Later phases include the Malwa (1700-1500 BC) and Jorwe (1500-1100 BC) (Possehl and Rissman 1992:483). Navdatoli is one of the biggest sites of the region. (Sankalia, et al. 1971; Sankalia, et al. 1958). Other well known sites include Daimabad (Sali 1986; Shinde and Pappu 1990), and Inamgaon (Dhavalikar, et al. 1988). These sites are early farming communities (Dhavalikar 1988) with exchange networks to the north and south.

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The Ahar-Banas Cultural Complex

In southeastern Rajasthan, many of the sites that were occupied during this period were known collectively as the Ahar-Banas Cultural Complex. The name springs from the first excavated site of the region, Ahar, which sits on the Banas River. More than 100 Ahar-Banas sites have been identified through survey, and five have been excavated.

When the sites were first discovered, the most pressing research question focused on the origins of the Ahar-Banas people. H.D. Sankalia, the father of modern Indian archaeology[2] who oversaw the excavations at Ahar, spent much of his career pursuing the origins of culture and civilization. At Ahar, as at every site he excavated, he sought to answer the question: from where did the inhabitants come? His answer always pointed to the west. Regarding Ahar he writes that several artifacts give evidence of "contact with or migration from such a distant city as Troy" (Sankalia 1999:36). Pondering evidence for the Stone Age, Early Iron, and Historical Periods in Rajasthan, he writes,

> I have taken the liberty to call each stage a colonization, that is the arrival of a new people, with readymade knowledge of the arts and crafts characteristic of that period. This appraisal of our present stage of knowledge may not appeal to some scholars, particularly in these days of racial and regional pride. To such scholars I can only say that my view is strictly provisional. It can be set aside or modified when more data is obtained (Sankalia 1999: 39).

This point of view has been critiqued (Chakrabarti 1968). While Sankalia has been routinely criticized for his, "blunt emphasis on the derivation of most of the things Indian from the West" (Chakrabarti 2003:77), the passage quoted here indicates that he was clearly open to other interpretations. Archaeologists after Sankalia pursued a host of research questions beyond the origins of the Ahar-Banas people. Today, the local

[2] Chakrabarti calls him, "the only true *guru* Indian archaeology has been able to throw up since Independence" (Chakrabarti 2003:77).

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emergence of the Ahar-Banas Cultural Complex is commonly understood, if not explicitly acknowledged. Researchers are more interested in identifying the socio-political make-up of the society, the patterns of subsistence, the nature of craft production, and networks of trade and exchange.

The Ahar-Banas Cultural Complex is based on a cultural historical approach and is largely defined by the presence of the distinctive Ahar Black and Red Ware pottery (burnished black on the inside, black fading into red on the outside, and marked with repeating white paint geometric designs) which signals a site's membership in this group. Other pottery types as discussed below also sometimes serve as identifying features. While pottery is the most obvious identifier, the Ahar-Banas sites share a number of non-ceramic common features. These include permanent architecture (of mud brick or stone), an agro-pastoral subsistence strategy, use of copper, and formal similarities among small artifacts like figurines and beads.

The site of Bagor, and other sites located in the Mewar Plateau that do not have obvious identifying artifacts, such as Ahar Black and Red Ware, are usually considered separately even when they overlap in space and time with the Ahar-Banas Cultural Complex. Although Black and Red Ware, other Ahar-Banas pottery, and other items formally similar to the Ahar-Banas Cultural Complex have been found at Bagor, these artifacts are explained as having been obtained through exchange. Instead of belonging to the Ahar-Banas, Bagor is frequently referred to as Mesolithic because of the thousands of microliths that cover the site. The site was first occupied in 5500 BC, prior to the Ahar-Banas. However, the upper layers are contemporaneous with the Ahar-Banas.

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The Archaeological Surveys

It is clear that the region known today as southeastern Rajasthan was extensively occupied after the fifth millennium BC. Three major surveys in the region located numerous mounds with Chalcolithic pottery as well as microlithic scatters. These are Misra's survey of the Berach River Basin (IAR 1956-57a, 1957-58b; Misra 1967), Hooja's survey of the Banas River Basin (Hooja 1988), and Dasgupta's survey of the 10 square km area surrounding Gilund (DasGupta 2006). Each of these surveys found dozens of sites, most within 1-3 km of each other. If we take into consideration the number of sites that have been destroyed due to agricultural or village land reclamation, it appears that the area was even more densely populated than these surveys reveal. As a cautionary note, however, it is important to keep in mind that the three surveys discussed here was limited to an area within a few square kilometers of a major river, or within a few square kilometers of a major site, which may influence our perceptions of settlement patterns and settlement density. In addition, it is not clear to what extant these sites were all simultaneously occupied.

In order to identify sites as part of the Ahar-Banas Cultural Complex the three surveys used ceramic typology, and the presence of Black and Red Ware as well as other common wares found at Ahar. Aceramic sites with microliths were designated Mesolithic (or Late Stone Age in Misra's case). Aceramic sites with large non-blade technology lithics were categorized as belonging to earlier time periods including the Upper Paleolithic.

Misra's survey of the Berach Basin (Misra 1967) recorded sites near the Berach River and its tributaries. He located nine Early Stone Age sites, 6 Middle Stone Age

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sites, 26 Late Stone Age sites, and 9 Ahar-Banas sites.[3] Misra observed great variety in lithic types between the sites that he documented and proposed a set of industries (named after the nearby tributaries) based on his findings, including the Berach industry, the Gambhiri industry, the Wagan industry and the Kadmali industry. In documenting the Ahar-Banas sites, he used a ceramic typology that included four major types: Cream Slipped ware, Black and Red Ware, Red ware, and Grey ware. Misra argued that the Ahar people moved into the area as a fully developed civilization and he hypothesized that they moved and settled from southwest to northeast. He further surmised that the Black and Red Ware manufacturing method came from Gujarat. He cautions, that, "It must, however, be emphasized once again that the archaeological research in Rajasthan is in its infancy, and the solution to present problems can be sought only in one direction, namely field work and more field work" (1967:209).

Hooja's survey (1988) of the area was limited to field checking previously recorded sites. In the course of her research she found several new sites and describes a total of 84 sites in some detail. While she discovered several Paleolithic sites, her detailed inventory is limited to those that she identifies as Ahar-Banas. Her survey seeks to determine the relationship between Ahar-Banas and Mesolithic sites. She argues that many of these sites were contemporaneous and the nature of their relationship is still unknown. Her report emphasizes the fact that microliths and Ahar-Banas lithics frequently co-occur. She also includes an ethnoarchaeological study of the Bhils, a local tribal people, so that she can compare the material record generated by a contemporary

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[3] Misra uses here the African chronology system of Early, Middle, and Late Stone Age, which was used in India for about a decade (Allchin 1963). It is more common today to use the terms Lower Paleolithic for Early Stone Age, Middle Paleolithic for Middle Stone Age and Mesolithic for Late Stone Age, although there is not exactly a one to one correspondence between the African, European, and Asian systems.

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mobile group, and build a model regarding interactions between mobile and settled communities. She concludes that some form of interaction —economic or otherwise — likely occurred between sites that are frequently called "Mesolithic," like Bagor, and sites of the Ahar-Banas. However, she cautions that the evidence is insufficient to determine exchange patterns.

Dasgupta conducted a systematic survey of sites in a 10 km^2 area surrounding the site of Gilund from 2000 to 2004 (2006). In her survey she found 28 sites that appear to be contemporaneous with Gilund. These sites range from small microlithic scatters with corroded pottery to large mounds. Performing a site catchment analysis, Dasgupta argues that most of the necessary raw materials for Gilund craft production could be found in the immediate vicinity including clays for pottery and mudbrick, cobbles for grinding and hammer stones, water, wood, and abundant edible wild plants and wildlife.

Taken together, these three surveys indicate that southeastern Rajasthan was extensively inhabited from 3000-1500 BC. A range of site sizes and types from modest temporary camps to small, medium, and large size mounds with evidence for long-term occupation existed.

The Excavations

Five Ahar-Banas sites in Rajasthan have been excavated since 1954: Ahar, Ojiyana, Marmi, Balathal, and Gilund. In addition, the contemporaneous sites of Bagor and Tilwara in the Ahar-Banas region also have been excavated. Each of these sites show evidence of long-term occupation at various points between 3700 and 1280 BC (see Table 2.1), and with the exception of Bagor, there is evidence that each of these was a settled village that practiced an agro-pastoral economy and engaged in small-scale craft

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production activities, as well as local and long-distance trade. Excavations at all of these sites have recovered a number of domestic grains such as barley, wheat, and lentils and domestic faunal remains including cattle and sheep/goat. It appears that pottery was produced locally at all of these sites, as were other crafts. However, not all crafts were locally produced; some were obtained from sites both near and far. The following site descriptions have been placed in order of excavation.

Table 2.1: Chronology of Excavated Ahar-Banas Sites

Ahar[4] 2660-1280 BC	**Balathal[5] 3700-1800 BC 600 BC-400 AD**		**Gilund[6] 3000-1700 BC**		**Marmi[7]**		**Ojiyana[8] 3000-1500 BC**
IIc	II (Early Historic)	600 BC-400 AD					
IIb	Unoccupied						III
IIa	II (Chalcolithic Phase B)	?-1800 BC	Late Ahar-Banas	2000-1700 BC	IV	~1500 BC+	IIb
Ic	I (Chalcolithic Phase A)	3700 BC - ?	Middle Ahar-Banas	2500-2000 BC			IIa
Ib			Early Ahar-Banas	3000-2500 BC			Ib
Ia							Ia

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[4] (Misra 2005; Sankalia, et al. 1969)
[5] (Misra 2005)
[6] (Shinde and Possehl 2005a)
[7] (Mohanty, et al. 2000)
[8] (Meena and Tripathi 2001-2002)

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Site by site descriptions:

Ahar

Located in the modern day city of Udaipur, on the banks of the Banas River, Ahar was the first site in this region to be excavated. The site consists of two mounds, the higher of which is 15 m high. It was visited by James Tod in December of 1820, who camped by the site for several days and had his crew dig in pursuit of antiquities. He wrote,

> The vestiges of immense mounds still remain to the eastward, called the *Dhool-kote*, or 'fort,' destroyed by 'ashes' (dhool) of a volcanic eruption. Whether the lakes of the valley owe their origin to the same cause which is said to have destroyed the ancient Ahar, a more skilful geologist must determine. The chief road from the city is cut through this mound; and as I had observed a regular opening of the mound in search of medals, and obtained a few with the effigies of an animal, which I fancied to be a lion, but others the *gadha*, or ass, attributed to Gundrufsén the brother of Vicrama, who paced this impress on his coins, the reason of which is given in a long legend. My impious intentions were soon checked by some designing knaves about the Rana, and I would not offend superstition. But the most superficial observer will pronounce Ar to have been an ancient and extensive city…" (Tod 1997 [1829]:620).

The first test excavations were conducted by Rajasthan Archaeological Department in 1952, 1954, and 1955 (IAR 1954-55a, 1955-56a). Only one trench of approximately 10 m by 20 m in size was excavated; very little has been published from these original excavations. The site was later excavated by H.D. Sankalia and a joint Deccan College-Department of Archaeology and Museums Rajasthan team in 1961-2, who dug twelve 5 m x 5 m trenches and three smaller trenches, covering three parts of the site (Sankalia, et al. 1969). Trench A, the deepest trench, was just over 11m deep and included 20 separate layers. Sankalia estimates that the site was occupied between 2660

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and 1280 BC based on a series of radiocarbon dates. He divides the occupation into Phases I and II, each of which has three subdivisions (a, b, and c). The analysis of artifacts below focuses on the "Chalcolithic" sections of the site, although it has been admitted that some mixing of materials may have occurred.

While the excavation methods of the day did not include screening of dirt or some types of data recordation that are now common, the archaeologists carefully preserved most materials. Focus was first and foremost cast on the antiquities, or small artifacts, and pottery. Lithics and faunal remains received less attention, although they were noted in the first site report (IAR 1954-55a:14) and included in the final report (Ansari 1969; Shah 1969). A total of 79 iron objects were found, including 36 pieces of slag (Sahi 1979). The earliest occurrence of iron (two pieces) was in the upper levels of Phase Ib, which dates to before 1270-1550 BC (Sahi 1979:366).

Because the excavations at Ahar were vertical, and not horizontal, no complete structure was unearthed. However, several partial structures were located, all of which were made of stone with mud plaster (Sankalia 1969b). The largest structure was built in three phases. The longest stone wall is approximately 9 m long and has three perpendicular adjoining walls as well as a parallel wall that is approximately 1 m away and runs about 5 m long. Thus, the structure, although not completely exposed, bears many similarities to the parallel walls uncovered at Gilund. Sankalia et al. note that a smaller structure found in another trench is similarly shaped (1969b:11). Other small stone structures seem to run north-south. Some of house floors from the lower levels were prepared with river gravel, while the more recent house floors were made of prepared clay and had been burned. Finally, *chulahs*, or prepared clay hearths, were

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found in some of the houses. Nagar suggests that the population of Ahar might have been around 1,218 (Nagar 1969)[9].

Sankalia's pottery typology included four major types: Buff and Buff-slipped ware, Black and Red Ware (unburnished, burnished, brown-slipped, coarse), Grey ware (burnished, unburnished, metallic) and Red ware (tan-slipped metallic, tan-slipped drab, tan-slipped with paintings, chocolate-slipped metallic). Each ware was comprised of a variety of shapes including bowls (small, carinated, convex, deep, rimless, lugged, squat, ribbed, hemispherical), vessels (globular, elongated, lota-like, small with carinated belly, ribbed, with concave neck), jars, dishes-on-stand, pots (high necked, miniature, rimless), and lids. This pottery typology proved to be instrumental to survey research conducted in the region following the original excavations (see for example Misra 1967). While the typology was modified somewhat by ceramic analysts at Balathal and Gilund (see below), the overall framework has been retained. The pottery sequences from Ahar have been used by surveyors to identify sites in the region as belonging to the Ahar-Banas culture. The chronology from Ahar is similarly influential and the relationship of ceramics and radiocarbon dates that came from Ahar have become a template that is laid upon the entire region. That is, Ahar, as the type-site of the Ahar-Banas Cultural Complex, and the Ahar pottery typology as devised by Sankalia, sets the standard for studying and understanding the rest of the region.

Unfortunately, many of the ceramics (Grey ware, some of the Red wares) are visually similar to types found in the rest of India for multiple time periods. They are not very useful for identifying other Ahar-Banas sites. As a result, archaeologists place a

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[9] This number was developed by hypothesizing the number of houses that can fit within the boundaries of the Ahar mound and then comparing the current population per household of the nearby village of Parla (now encapsulated within the city of Udaipur).

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great deal of importance on the presence of a single pottery type to identify an Ahar-Banas site: white painted Black and Red Ware. This ware is usually made of a very fine, possibly levigated matrix, and usually takes the shape of small bowls. They are mainly black on the interior, and painted with sequences of short parallel white stripes, also on the interior. The distinctiveness of this pottery-type makes it quite useful for identifying sites that belong to the contemporary time period.

Balathal

Balathal is located near the Kataranadi, a very small tributary of the Banas River. There is a large flat geological depression adjacent to the site that also might have served as a source of water most of the year (Misra 2005). Balathal was excavated by the archaeologists at Deccan College as a field school during the winter seasons of 1994 through 2000. Although a small site (it measures approximately five acres), the excavations were 7 meters at their deepest. The excavations sampled both the central, undisturbed, part of the mound, and the exterior perimeter where plowing had occurred. The finds are still being studied and published. However, the initial reports indicate that the site was occupied from 3700-3000 BC to 1800 BC, abandoned for a period, then reoccupied from approximately 600 BC to 400 BC (Misra 2005). The summary presented here focuses on the early period of occupation only, which the archaeologists have divided into Phases A and B.

The early occupations consisted of stone, mud brick, and wattle and daub household structures as well as a major stone lined enclosure (37 m x 27 m; the walls are 3.5 m to 4 m high and 5 m to 6.5 m wide) that was presumably used to pen cattle (or some other domesticated animal). The housing structures are square to rectangular in

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shape and many consist of multiple rooms and courtyards, some with *chulahs* and *in situ* querns; the largest complex is comprised of eleven rooms.

In addition to significant architecture, the excavations produced abundant pottery, faunal remains, a few lithics, copper, and a number of antiquities with formal similarities to other nearby sites. The people of Balathal practiced a mixed agro-pastoral economy with some small-scale craft production (two kilns were found on the site). The pottery at Balathal has been extensively studied. Sankalia's typology was refined and the ceramics were classified accordingly (Mishra 2000; Dandekar 2005); x-ray diffraction was performed on some of the sherds (Gogte 1996), and an *in situ* cache of pottery was analyzed in relation to its immediate provenience (Misra and Mohanty 2001).

Mishra's ceramic typology consists of twelve types that fall into two broad categories: fine and coarse wares (Mishra 2000). Fine wares found in all time periods include: black-and-red, reserved slip, perforated, and buff. In addition, fine red wares are only found in early deposits while thin red ware and Tan and Chocolate slipped are only found in later deposits. The coarse wares are grey ware and red slipped (both early only), thick red slipped and grey slipped (both late only), and coarse red (found throughout the deposit). Mishra's analysis concludes that pottery production evolved over time at the site of Balathal and passed through four phases: Beginning, Transitional, Mature, and Late Mature. According to his analysis, the beginning phases show the crudest pottery using only slow-wheel techniques; the quality of the pottery and the sophistication of techniques increases with each phase until the late mature phase, when a decline is once again observed (Mishra 2003).

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Among the exciting pottery finds at Balathal was a cache of vessels found buried in a house floor in a room identified as a kitchen which was dated to 2880-2462 BC or Chalcolithic Phase B (Misra and Mohanty 2001). Six small fine vessels were found carefully stored in a large globular Grey ware pot that had been deliberately buried in the floor. The vessels include three Black and Red Ware bowls that are painted with differing patterns in white paint, a medium-sized Grey ware globular jar and a small Grey ware globular vessel. The sixth vessel is a medium sized S-shaped Grey ware pot that held 42 steatite disk beads and an unspecified number of Job's tears that had also presumably been used as beads. The authors conclude that the vessels were a "dining set, which was of special importance, and, therefore, carefully stored inside the large globular jar" (Misra and Mohanty 2001:74).

A sourcing study using X-ray diffraction (XRD) performed on 124 sherds from Balathal, using equipment at Deccan College, demonstrated that Balathal relied heavily on imported pottery (Gogte 1996). The study also examined clay samples from the area near Balathal and Gilund as well as some sherds from Ahar, Gilund, and Kayatha (a site in Madhya Pradesh) as comparison collections. Gogte concluded that less than 40% of the pottery was locally produced at Balathal; the majority came from multiple sites, some of which he was able to identify, and others which he could not (Gogte 1996). Locally produced wares included large pots made from thick bright Red-slipped ware (with the exception of sherds from one layer which were produced elsewhere) and some thick Grey ware sherds (others were produced at unknown sites). Wares not produced at Balathal include Thin Red ware (which may have come from Gilund), Reserved Slip ware (which came from multiple sites), the Sorath-resembling Tan ware (all sherds of which appear to

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have come from a single unidentified site), and Kayatha ware. Analysis of the signature Ahar Black and Red Ware indicated multiple sites of production. Visually, vessels made in this ware show great variation between levels, an indication that these items were made by multiple producers. In sum, the XRD analysis indicates that some samples were locally produced, while others may have been produced at Ahar. There does not seem to be strong indication that exchange patterns differed over time.

Several copper artifacts were recovered from Balathal. These include arrowheads, knives, a chisel, a chopper, bangles, a decorative piece, and a nail. The nail was analyzed using optical microscope, SEM, and XRD. The SEM results suggest that the nail had been made by casting and then later cold-worked (Srivastav, et al. 2003).

Marmi

Marmi, also known as Purani Marmi in order to distinguish it from the contemporary village of the same name, is located on the banks of the Banas River, and is elevated several meters above the course of the river. It is quite large and is partly under cultivation at this time. Several major natural erosion channels have developed and run from the middle of the site down to the riverbed. These erosion channels are quite deep and cut through the deposition as well as the sterile soil underneath. As a result, the site of Marmi is quite disturbed today.

Marmi was first identified through survey (IAR 1957-58a); more recently two 1 m by 5 m trenches were excavated in 2000 (Mohanty, et al. 2000). The excavators used the site's erosion gullies to their advantage and set their trenches so as to create a clean and visible profile. They found that the deposition was 1.5 m to 1.7 m deep and included

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Chalcolithic and Early Historic artifacts. Unfortunately, their excavations were not extensive enough to allow them to identify any structures.

Using the pottery typology from Balathal, the analysts identified five types of pottery at Marmi: Black and Red Ware, Thin Red Slipped ware, Thick Red Slipped ware, Grey Slipped ware and Coarse Red ware. Some typical wares of the Ahar-Banas that have been identified at Balathal and Ahar were not found at Marmi. These include: Tan, Chocolate Slipped, Thin Red ware, and Reserved Slip (Mohanty, et al. 2000: 136). The excavators conclude that there are substantial differences between the pottery of Balathal and Marmi, but that Marmi pottery is somewhat similar to that found at Gilund (this statement was made prior to the excavations at Gilund). They argue that the reason for this difference is that Marmi was occupied towards the end of the Chalcolithic (beginning approximately 1500-1400 BC) and could represent a Phase IV in the Ahar-Banas Chronology (Phases I-III being present at Balathal).

The terracotta bulls are the most distinctive feature of the Marmi artifact collection. Like Ojiyana, Marmi produced many small baked terracotta bulls. A team from Deccan College collected 58 terracotta bull figurines during a survey in 1993 (Misra, et al. 1993). The analysts divide the bulls into three categories: naturalistic figurines with a hump, naturalistic figurines without a hump and stylized figurines. Those of the first two categories are formally similar to bulls found at other Ahar-Banas sites such as Ojiyana and Gilund. However, the stylized figurines are unique to Marmi. They do not have any limbs and consist of an upright cylindrical form with two horns on the upper portion. Sometimes a slight nodule indicates the presence of a face, but usually these bulls are faceless. In addition, the horns are frequently broken and missing. The

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analysts suggest that these bulls may have been made locally at Marmi for ritual purposes. They make an analogy with several traditions among contemporary Indian tribal people who also use small bull figurines in their worship. Because Marmi has produced far more bull figurines than other sites, Misra et al (1993) suggest that Marmi may have been a kind of religious center, although the large size of the mound and the unique depositional circumstance at Marmi may also contribute to this phenomenon.

Ojiyana

Ojiyana is the farthest north of all the excavated Ahar-Banas sites, and is located amongst the hills of the Aravallis. It is the only excavated site that is not located near a river or tributary; and the excavators suggest that its source of water was likely the many ponds that are located in the hilly region. Centrally located between the cluster of Ahar-Banas sites and those of Ganeshwar-Jodhpura Cultural Complex, Ojiyana potentially played an important role in facilitating long-distance trade of copper and other goods. The site was found in 1980 by R. C. Agrawala and excavations by the Archaeological Survey of India began in 2000 (Meena and Tripathi 2000, 2001, 2001-2002). In the first two seasons (a total of ten months of excavation) fifty-three 5 m by 5 m trenches were excavated in two separate locations at the foot of the hill. The deepest trench was 7.5 m with 26 separate layers. The excavators pursued both a vertical and horizontal strategy, which allowed them to gather chronological data as well as settlement patterns.

While radiocarbon tests have not yet been run, the excavators estimate that Ojiyana was occupied between 3000 and 1500 BC and based on pottery sequences, they designated three separate phases within this time period: I, II (a and b), and III. The horizontal excavations allowed them to uncover several complete structures in Phase IIb,

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but not the other phases. The Phase I structures were comprised of mud bricks with clay floors and were heavily disturbed by erosion debris that came down from the hillside. Phase II houses were aligned East-West and made of stone and mud plaster with bamboo and mud roofs. The excavators describe the settlement as, "well-planned" with parallel streets and a surrounding fortification wall. The houses consist of multiple rooms and courtyard areas. *In situ* querns and *chulahs* were found in some of the rooms. In addition, the excavators argue that one of the structures served as a communal granary. Phase III structures are smaller than Phase II and do not follow any specific orientation. Some are made of stone; others of wattle and daub with clay floors. The excavators argue that the houses were built in the streets of Phase II, indicating lack of town-planning and a "degeneration in civic system" (Meena and Tripathi 2001-2002:53). A number of subterranean lined storage pits were identified. It is presumed that these were used to store grain at the household level.

The excavators identify the distinctive Ahar-Banas white-painted Black and Red Ware in all of the Phases at Ojiyana. In addition, they found Black Slipped ware, Grey ware, Tan ware, and Red Slipped ware. The most distinctive find from Ojiyana seems to be the number of small baked terracotta bulls and cows. While terracotta bulls are found throughout the Ahar-Banas area, the ones at Ojiyana are distinctive because they are painted white. In addition, cows have not been found at any other Ahar-Banas site. Other antiquities include spindle whorls, sling balls, toy cart wheels, "gamesmen" (small baked terracotta objects of various sizes), "hopscotches" (ground pottery shards), and beads of various materials. The publications do not discuss lithic tools and only briefly announce that some copper was found at the site.

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Gilund

Gilund, a two mound site that is approximately 25 ha in size, was first identified through a regional survey as "Bhagwanpura" (IAR 1957-58a:45). It was excavated by B.B. Lal who set four large trenches: GLD-1 (120 ft x 33 ft), GLD-1A (216 ft x 13 ft), GLD-2 (fourteen 20-ft squares), and GLD-3 (six 20-ft squares) (IAR 1959-60a:41). While Lal did not extensively publish his findings, a small report (IAR 1959-60a) describes the architecture and artifacts in general terms. Lal most likely employed the common excavation techniques of the time and therefore did not screen the excavated dirt.

In 1999 a joint team from the University of Pennsylvania and Deccan College undertook new excavations at the site. They excavated for a total of five seasons from 1999 to 2005 and dug over one hundred 5 m x 5 m trenches across both mounds. A deep trench on GLD1, the tallest mound, ran nearly 5 m deep and never hit sterile soil, although the excavators surmise that sterile soil was close since the lowest levels were comprised of the kind of sandy soil that is local to the area, and contained very few artifacts.

The original excavations did not provide any radiocarbon dates. However, the new excavations ran six sets of radiocarbon dates by Beta Analytic in Miami, Florida. The results are presented in Table 2.2.

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Table 2.2 Gilund Radiocarbon Dates

Trench	Sample Numbers	Measured Radiocarbon Age	Conventional Radiocarbon Age	2 σ Calibration
GLD1-4F	Beta-215006 Lot no. 4F-4003	3870 +/- 40 BP	3860 +/- 40 BP	BC2460 to 2200 (BP 4410 to 4150)
GLD1-4F	Beta-215007 Lot no. 4F-4004	3800 +/- 40 BP	3790 +/- 40 BP	BC 2330 to 2130 (BP4280 to 4080) AND BC 2080 to 2060 (BP4030 to 4010)
GLD1-4F	Beta-215008 Lot no. 4F-4006	3840 +/- 40 BP	3840 +/- 40 BP	BC 2450 to 2190 (BP4400 to 4140) AND BC 2170 to 2150 (BP4120 to 4100)
GLD2-5	Beta-140702			1742 BC
GLD2-57	Beta-216401 Lot no. 5570012	3290 +/-40 BP	3320 +/- 40 BP	BC 1690 to 1510 (BP 3640 to 3460)
GLD2-65	Beta 216402 Lot no. 5650027	3220 +/-40 BP	3270 +/-40 BP	BC 1630 to 1440 (BP 3580 to 3390)

It appears that the site was occupied from 3000 BC through approximately 1700 BC. The excavators divide the earliest periods into three phases:

Late Ahar-Banas	2000-1700 BC
Middle Ahar-Banas	2500-2000 BC
Early Ahar-Banas	3000-2500 BC

A temple on the top of GLD1 is still in worship by the residents of the contemporary village of Gilund, located approximately 1 km away. Excavations uncovered multiple house structures, a large building comprised of long parallel walls, a workshop and several midden areas. Preliminary faunal and ethnobotanical analyses indicate that the inhabitants practiced a mixed agro-pastoral subsistence strategy that they supplemented with wild plants and animals such as fish, turtles, and nilgai/antelope

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(Landt 2007). Intense burning and vitrified remains in two separate parts of the site indicate workshop areas for small-scale craft production. A full pottery analysis is still underway, but preliminary findings indicate that wares similar to those found at the other Ahar-Banas sites also were present at Gilund. Antiquities in the form of animal figurines and sealings show similarities to other sites in South and Central Asia. For example, a few pieces of pottery strikingly similar to those from Rojdi, in Gujarat, have been found at Gilund. A number of *in situ* seal impressions appear similar to those found at Chanhu-daro, Pirak, Kot Diji, and Nindowari as well as the Bactria-Margiana Complex (BMAC) in Central Asia (Possehl, et al. 2004). The implications for these findings are discussed below. The lithics from Gilund will be discussed in more detail in Chapter 6, as will a more extensive description of the excavation methodology.

Bagor

The site of Bagor, originally excavated by V.N. Misra (IAR 1967-68b, 1968-69, 1969-70; Misra 1971b, 1982), is a fossilized sand dune that lies on the banks of the recently dried up Kothari River. The site largely consists of a microlithic scatter and was a temporary home to a group of mobile peoples who practiced hunting and gathering as well as pastoralism and possibly cultivation. The site was first inhabited at 5500 BC, prior to animal domestication in this region, but was continuously used until approximately 200 AD. The original excavators divide the site into three phases (Misra 1973, 1982):

Phase III	600 BC-200 AD
Phase II	2800-600 BC
Phase I	5000-2800 BC

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Phase I and II structures are made of schist stones procured from the outcrops across the river. No full walls were encountered; instead, the stones were used as house floors in structures that were made of perishable materials.

Phase I is largely considered to be aceramic, although some small pieces of eroded pottery were found in the levels associated with Phase I (Misra 1973:100). Phase II pottery is generally poorly fired, but resembles pottery sequences in the region. Although Misra does not believe Bagor pottery to be truly Ahar-Banas pottery, he believes that the style is the same. He writes:

> Some affinities are noticeable between Bagor pottery and that of the Ahar Culture in Mewar…and of the Kayatha culture in Malwa…The surface treatment of Bagor pottery is similar to that of the red ware of the Ahar culture though in the latter the red wash has proved to be more durable. Some of the shapes such as the large, shallow basins, deep, straight-sided bowls and the large neckless jar are common to the pottery of the two cultures. In decoration the Ahar pottery (excepting the black-and-red ware) like that of Bagor, is characterized by incised designs, and the motifs found at Bagor are all present at Ahar as well. The presence of a few black-and-red ware sherds at Bagor also provides a hint at some link with Ahar (Misra 1973:103).

Interestingly, the pottery from Tilwara is described as, "totally different" from the pottery of Bagor (IAR 1967-68c:40).

Bone beads and stone beads said to be made "of banded agate, carnelian or garnet and are of short tubular, or barrel-shape," were found in Phase I and II, including a stone bead necklace in a Phase II burial (Misra 1973:105). A copper spearhead, copper awl, and three copper arrowheads that Misra argues somewhat resemble Harappan arrowheads were also found, some of them in Phase II burials (Misra 1970). Hammerstones, groundstones, two perforated stones, and a spindle whorl were also found in Phase II (Misra 1973:105).

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Although five burials were recovered (Kumar 1970-73), only one is from Phase I and three are from Phase II (Kennedy 1982). No burial goods are associated with the Phase I burial, although several pots were buried with the deceased in Phase II along with the copper arrowheads and a stone and bone bead necklace (Misra 1982). The skeletons were poorly preserved. The Phase I skeleton was a female between 17 and 19 years old at death (Kennedy 1982:33). It was badly damaged by post-depositional processes and excavation, part of the skeleton was lost in transport between the site and the Museum, and a portion of the right foot belongs to another individual (Kennedy 1982:32-3). While Kennedy had difficulty determining the reconstruction of the skull, most teeth were available for study and appeared to be little worn (Lukacs 1982:81). The Phase II skeletons included a female in her late 30s, a 7-8 year old child, and a male in his early 40s (Kennedy 1982). Only two of the Phase II skeletons had teeth. The child had teeth without any visible attrition or pathology. However, the adult female had teeth that were highly worn as well as dental carries. Her teeth resembled those from other Chalcolithic sites of the Deccan (Lukacs 1982:82).

Vast quantities of faunal remains were recovered from Bagor, however, most were fragmentary. The initial faunal analysis indicated that Phase I fauna only included wild species; later studies identified domesticated animal remains in Phase I and II including sheep/goat and cattle (Thomas 1975, 1977, 1984). In recent years, the faunal analysis has been challenged since archaeologists have learned more about the bone structure of the local wild animals of Rajasthan (Meadow and Patel 2002).

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Recent microwear and starch grain analysis (Kashyap 2006) indicates that the inhabitants prepared and consumed a variety of fruits, pulses, and grains. However, Kashyap notes that,

> Much more work on the ground collecting the wild and domesticated taxa and studies in the laboratory must be conducted before we can say for sure if the plants found at Bagor are crop plants or near wild relatives (2006:195).

Thus, it is not clear whether the inhabitants at Bagor were producing wild or domestic foods. There is also the possibility that either wild or domesticated foods may have been obtained elsewhere and brought to the site.

Occupation of the Mewar Plain in the First Few Millennium BC

The Mewar Plain appears to have been densely occupied from the third millennium through the first millennium BC. The people who lived in the area known as the Ahar-Banas Cultural Complex practiced an agro-pastoral subsistence economy that also took advantage of local wild plant and animals. They grew wheat, millet, barley, lentils, peas, and safflower. In addition, they raised cattle, and sheep/goats. They consumed wild fruits like bor and gathered plants for such as Job's tears (which may have been eaten or used as beads for necklaces). Finally, a small part of their diet consisted of wild animal meat including antelope, gaur, nilgai, birds, fish, and turtles. Like other early farming communities, the settlements of the Ahar-Banas largely practiced seasonal activities and their subsistence varied throughout the year. For example, wheat is usually grown in winter, while barley, lentils, millet, and peas are not. The findings of rice at Ahar suggest that the inhabitants may have employed irrigation, which requires a great deal of maintenance work during some seasons. Bor becomes ripe

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in late winter, just before the hot season. Birds may have been hunted in the rainy season, when hundreds of large flocks visit the area during their annual migration to take advantage of the thousands of spontaneous pools that appear. Alternatively, the dry season would have also provided hunting opportunities as birds and other animals congregate near the few remaining water sources.

Just as the early farming villages in the region shared similar subsistence and annual activity patterns, they appear to share similarities in craft production. Most of the sites demonstrate some evidence of small-scale craft production in the form of small workshops (Gilund), kilns (Gilund, Balathal), or artifacts (like crucibles and raw steatite at Balathal, slag at Ahar, bead blanks at Ahar). The presence of spindle whorls suggests that wool cloth was also produced at each site. Some of these activities could have occurred at home or in small workshops, but no evidence of large-scale craft production has been noted in this region. There is no evidence of centralized production or political oversight of crafts. Craft-production most likely occurred at the household or family level. While some may have practiced a craft in addition to other activities (such as cultivation), the presence of workshops indicates that some may have practiced their craft full-time. The sites of the Ahar-Banas had integrated economies.

Although many crafts were produced at each site, others were clearly imported. Worked shell in the form of spoons, bangles, pendants, or other items came from the ocean, presumably from Gujarat. Similarly, while all of the sites have plentiful steatite beads, only the Balathal excavations found raw steatite; the other sites must have obtained these items as finished products. The XRD and other analyses conducted on Balathal sherds indicates that some pottery was manufactured on site, while other pots

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came from multiple sites both in the immediate area as well as further away (Gogte 1996). Such studies indicate that the sites of the Ahar-Banas area engaged in intricate trade and exchange relationships that belie assumptions that ancient Indian villages were self-sustaining enclosed units.

Formal analysis of multiple artifacts also suggests that several crafts were exchanged. While formal similarities exist between many of the small items, like animal figurines, it is quite possible to explain some of these similarities through shared artistic perceptions. For example, it appears that each of these sites produced the identifying white painted Black and Red Ware. Each site followed the common design of black burnished interior with partially black, partially red exterior. Moreover, each site picked a number of similar motifs when painting the bowls and other vessels white. Each site shared a common perception of what a proper Black and Red Ware bowl looked like. While there is some variation between sites, much is similar. In contrast to such items, however, other artifacts are quite distinctive and have come to be associated with specific sites and regions. Artifacts like seal impressions indicate that the reach of Ahar-Banas sites extended far to the north and southwest. Hooja and Kumar state that, "the Ahar Culture undoubtedly had some level of contact with Chalcolithic sites of the Kạyatha, Malwa and Jorwe 'cultures' further south in present day Madhya Pradesh and beyond. This interaction between Ahar and the Kayatha, Malwa and Jorwe 'cultures' groups of sites needs to be further examined" (1997: 333).

Raw materials that hint at trade from far away places include marine shell (from Gujarat) and lapis lazuli at Ahar (from Afghanistan). Copper likely came from the Khetri Copper Belt in the Aravalli Mountains to the west, and may have been smelted in other

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regions before transport.[10] The analysis of the Balathal copper nail suggests that cold working could have occurred on-site; but perhaps the initial product was smelted and cast near the source of copper and transported after manufacture (Srivastav, et al. 2003). While copper offers supporting evidence for local exchange networks, shell and lapis lazuli point to much broader networks that stretch to the north and southwest. The raw material evidence supports conclusions drawn through the formal analysis of artifacts.

Evidence for the existence of local and broad exchange networks begs the question of how such networks functioned and the relative importance to local economies. While it is not clear how trade goods moved across the landscape, it is possible that the rivers were a fast and easy way to move goods for some portions of the year. As mentioned above, most of the Ahar-Banas sites are located on a river or tributary that in times past held water for most of the year. While these rivers did not reach to the BMAC area or to the Arabian Sea, they provide quick local access between many of the sites. In many regions at this time mobile pastoral groups served an important role in moving goods between sites and acting as itinerant salesmen. It is possible that similar groups, perhaps those that inhabited sites like Bagor, also served such a function in the Ahar-Banas area. While the villages of the third through first millennium BC were clearly integrated it would be inaccurate to place them at the periphery of a center such as the Indus. Such a portrayal would not accurately reflect the social and economic relationships that flourished at that time.

While the quantities of imported goods appear to be low, it is difficult to say how valuable rare goods like marine shell bangles may have been. The ability to obtain such goods or to entertain long distance relationships may have been limited to some parts of

[10] The Ganeshwar-Jodhpura area is the most likely candidate for this.

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society and indicate that some form of social stratification likely existed at Gilund. In other parts of the world, luxury goods have been shown to play an important role in increasing political complexity. Without denying the power of elites to control resources and procure select items, it is equally important to acknowledge and investigate the elaborate informal economies based on ordinary goods that appear to be outside the realm of elite concern (Smith 1999). By studying the procurement and flow of ordinary goods, we broaden our conception of the role of economies within the greater social and political context.

The excavation of five sites in this region allows for some consideration of the evidence for ancient political structures. The presence of large communal architecture like the parallel walls at Gilund, suggest that communities worked together to create communal buildings. But these buildings do not require the kind of labor that large monuments require and their construction possibly benefited the entire community. The extant that construction labor was coerced, overseen by an individual, or emerged from communal decision making is unknown. The existence of craft workshops, rare luxury goods, and sealings, indicate that the society was stratified, but does not provide us with any information about the political structure. Finally, the presence of an exterior wall at Gilund, Balathal, Ahar, and Ojiyana may indicate that each site felt threatened by its neighbors. However, whether this perceived threat references violent attacks or cattle raids, and whether this threat was real or perceived remains to be seen. There are no figurines or other representations of revered individuals. In short, there seems to be no evidence of an overarching centralized leadership or governing body that spans the entire region and at this stage it seems most appropriate to suggest that each site was its own

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political entity with its own governing institutions. Perhaps, like the Indus, the Ahar-Banas is an example of "sociocultural complexity without the state" (Possehl 1998).

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Chapter 3. Conceptualizing Hunter-gatherers, Pastoralists, and Farmers

Introduction

Southeastern Rajasthan from the third millennium BC to the present has been made up of a mosaic of communities who have pursued a variety of economic strategies. The inhabitants of sites like Bagor engaged in subsistence and mobility practices that were distinct from more permanently settled sites in the region, like Gilund. Typically, the archaeological literature separates sites like Gilund and Bagor by subsistence type and mobility and links them through exchange. In building this model, most researchers rely on the careful evaluation of ethnographic evidence collected in South Asia and around the world. Many of these ethnographic studies focused on hunter-gatherer subsistence, mobility, and exchange strategies and practices. However, the vast ethnographic literature on pastoral and peripatetic peoples may provide a better analogy for the archaeological record in southeastern Rajasthan for two reasons. First, ethnographers of the past few centuries have noted that southeastern Rajasthan has not been inhabited by hunter-gatherers in modern times (Allchin 1977). But, more importantly, the stratigraphic levels at Bagor that are contemporaneous with Gilund show evidence of plentiful domesticated animal remains (see discussion in Chapter 2).

This chapter will review the ethnographic, historical, and archaeological sources that have served as the models to explain how Bagor fits into the third millennium BC society of the Mewar Plain. The discussion will cover subsistence, mobility, cultural diversity, and interaction. This literature review also will present research on pastoral

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peoples with a special focus on research conducted in Rajasthan and Gujarat. Finally, the archaeological literature will be reviewed in order to compare Gilund and Bagor to sites with similar archaeological remains in other regions within South Asia and other contemporaneous regions. By updating and broadening the ethnographic sources which serve as models for analogy building, it is possible to evaluate and elaborate on previous explanatory frameworks.

Evolutionary Frameworks

At times, evolutionary models have been used to characterize microlithic-rich sites like Bagor because many were inhabited by hunter-gatherers. Early models of human variation placed hunter-gatherers further down on the evolutionary scale than those who farmed or herded animals, even when they were contemporaneous (Morgan 1964 [1877]). In Service's framework, subsistence strategy roughly corresponded to a stage of evolution; foragers were bands and tribes, while agriculturalists and pastoralists were associated with states (1962). Considered to be savages, bands, or egalitarian societies, hunter-gatherers occupied the lowest rung on each of these social evolution ladders. Each society had to pass through each stage of complexity before proceeding to the next, in a form of unilinear evolution. In these models, technology directly influenced evolution (White 1959). Thus, in these "developmental models" (Bettinger 1991), contemporary hunter-gatherers were presented as "fossils" of previous human stages and time periods, like the Mesolithic.

However, unlike unilinear models, multilinear models suggested each society could evolve to its own ends and was not required to pass through a sequence of evolutionary stages (Fried 1967; Service 1962). Multilinear models argued that each

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society did not have to evolve in the exact order of band, tribe, chiefdom, state. Instead, each society could follow its own trajectory that may or may not reach an apex of the state or a stratified society. Using this paradigm, some have argued that contemporary hunter-gatherers are the modern day descendents of Mesolithic period hunter-gatherers while modern day villagers and city dwellers are descendents of the first farmers (Cooper 1997; Misra 1990; Murty 1981). Proponents of this framework sometimes claim that modern farmers follow a way of life that is traditional and largely unchanged from the way of life pursued by the first farmers.

Although hunter-gatherers, seen as primitives, were once derided as not only evolutionarily backward, but conducting a difficult and "brutish" lifestyle (Hobbes 1968), they were also idealistically raised by philosophers to a pristine status above the rest of civilization (Rousseau 1984). The latter point of view was very influential in ethnographic work that viewed hunting and gathering as a lifestyle of leisure and affluence. For example, Sahlins called hunter-gatherers the "original affluent society" (Sahlins 1972). This perception has been soundly critiqued based on the data used to construct that model (Bird-David 1992b) and by those who argue that hunting and gathering can be uncertain and difficult work and not necessarily economically rewarding (Kaplan 2000; see also articles in Schrire 1984).

Some archaeologists working in South Asia utilize aspects of evolutionary approaches in their work. Most commonly, studies of "Mesolithic" sites are subject to this framework. The term "Mesolithic" has been defined variously by different researchers but is frequently understood to refer to Holocene hunter-gatherers and sites are sometimes identified in the field as such through the identification of microlithic

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scatters. As a result, early Holocene sites and those of microlithic-using hunter-gatherers from any time period are frequently collapsed into one category—Mesolithic—with evolutionary implications (see Chapter 5 for a further discussion on the Mesolithic). As an alternative to using evolutionary models to analyze hunting and gathering groups of the ancient past, other archaeologists draw from ethnographic work done on hunter-gatherers in the 1960's and 1970's.

Ethnographic Models—Economy

Ethnographic Models of Hunter-gatherers

Ethnographic work in the 1960's and 1970's such as the Harvard research project among the Kalahari San (Lee and DeVore 1976) and the Man the Hunter Conference of 1966 (Lee and DeVore 1968a) focused the anthropological spotlight on hunter-gatherers. Meanwhile, Binford's call for middle-range studies (Binford 1977) added to a trend amongst archaeologists to draw models for Paleolithic and Holocene foraging societies from ethnographic research. Research at the time called previous typological and evolutionary frameworks into question by recognizing the fluidity of subsistence practices, re-evaluating the relationship between mobility and subsistence strategies, and rejecting the image of the primitive isolate. Scholarly frameworks shifted from an emphasis on evolution to an emphasis on ecology and history.

Revisionists sought to provide a historical context to hunter-gatherers (Headland 1997) and suggested that hunter-gatherers were marginalized people who had relatively little political power compared to farmers and other land owners. As villages, towns, and cities expanded and farmers claimed more and more land, hunter-gatherers were forced to

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subsist in smaller, less productive, and marginalized areas (Lee and DeVore 1968b). This outlook along with the argument that modern-day hunter-gatherers make poor models for ancient hunter-gatherers, in part because they lived and traveled in resource rich areas sparked the revisionist debates (Shott 1992; Wobst 1978). These debates largely focused on ethnographic work in Africa and Australia; hunter-gatherers in Asia were largely ignored. While the revisionist debates were raging, a different discussion was emerging amongst those who worked in South and Southeast Asia.

Just as important as the re-evaluation of evolutionary frameworks, subsistence practices and mobility, ethnographic research in South and Southeast Asia called into question the traditional depiction of hunter-gatherers as social isolates. Richard Fox, working in India, argued that work in Australia and North America provided limited models that could not simply be pasted onto Asian hunter-gatherers. Fox believed that the "social terrain" must be examined along with the "natural terrain" and refuted the notion that hunter-gatherers were social isolates (Fox 1969:141). Instead, he suggested that hunter-gatherers frequently traded with local farming villages and acted as "professional primitives." Providing examples from Kerala, Jharkhand, Andhra Pradesh, and Sri Lanka, Fox showed that forest goods such as "honey, wax, rope and twine, baskets, and monkey and deer meat" were traded for "iron tools, rice, arrow-heads, etc." (Fox 1969:141).

Fox was not the only anthropologist to make this finding. Gordon (1984) refuted the idea that the Bushmen were social isolates in the Kalahari until the 1950's by examining historical documents. He found that the Bushmen were well integrated into both colonial and local (with the Herero) economic networks. Griffin (1984) also used

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historical colonial documents to find that the Agta of the Philippines had traded with farmers and loggers for centuries. The Punan of Borneo also were well integrated into the colonial raw material extraction system. They provided a number of items including wood, resins, foods, and rhinoceros horns to the Chinese through down-the-line trade (Hoffman 1984). Hoffman argues that hunting and gathering was not the main economic activity of the Punan. He states that,

> Punan do not collect forest products to support themselves while hunting; they hunt, gather, and fish to support themselves while collecting forest products. Trade is not just another thing the Punan do; it is the thing that Punan do most. The collection and trade of forest products, not hunting, is the historic raison d'être of nomadic, primary-forest groups known as Punan (Hoffman 1984:143).

This is an interesting twist on the way that hunter-gatherers are conceived because it considers their entire economic strategy as a whole, instead of focusing exclusively on subsistence.

Headland and Reid (1989) showed that many anthropologists along with the popular press held onto the myth of the primitive isolate long after archaeologists, linguists, and anthropologists began to challenge the concept. They provide convincing evidence that with few exceptions, hunter-gatherers around the world have been economically interconnected with their neighbors who practice a variety of subsistence practices since the beginning of the Holocene. They also demonstrate that since the Holocene there have been few groups who exist solely by hunting and gathering and that there is ample historic and archaeological evidence that most groups around the world intermittently practiced pastoralism or some form of agriculture.

Hunter-gatherers and farmers exchanged not just crafts, but food items. Exchange of food resources between groups may have helped to buffer against food shortages. In

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addition, food exchange occurred as a form of mutualism whereby food resources normally lacking in one groups's subsistence strategy, such as fat or carbohydrates, was obtained (Spielmann 1986). The Agta-Palanan exchange of wild meat for domestic crops is one such example of this type of exchange (Peterson 1978).

While hunter-gatherers were once thought to be organized in egalitarian bands, contemporary research showed that there were frequently status differences within and between groups. The perceived relationship between egalitarianism and "immediate return" economies has contributed to this viewpoint, although some hunter-gatherers participate in "delayed return" economies (Woodburn 1968). However, it has become clear that social organization among hunter-gatherers is flexible (Morris 1982a).

The same can be said for pastoralists. Although they were once thought to hold the position of mid-level non-state societies, pastoralists were clearly capable of creating complex societies. The Mongols, nomadic pastoralists, are an example of an empire that was created by non-sedentary non-farmers.

Ethnographic Models of Pastoralists

Dyson-Hudson and Dyson Hudson (1980) argue that it is very difficult to generalize about pastoralists because centuries of ethnographic research have demonstrated that there is great variety in mobility and herding strategies as well as non-pastoral activities and social and political structures. According to Salzman and Galaty (1990b:7-8), "both nomadism and pastoralism can be best approached as labels attached to a set of continua or dimensions or variables capable of conceptualizing degrees and kinds of livestock production and mobility."

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Very few groups identified as pastoral practice a purely pastoral regime without engaging in other subsistence or economic activities. For transhumant groups, many herders are part of a household or community that farms, produces crafts, or engages in wage labor, or other market activities. That is, herding is merely one part of a subsistence and economic strategy. Even some nomadic groups farm; in these cases, either the whole group plants crops during their migratory route or the group fissions during the planting and harvesting season in order to maximize their options. Many pastoralists engage with the market by selling meat, milk, wool, hair, and hide. In addition, many times pastoralists rely heavily on craft production using pastoral products like wool and hair. Pastoralists who emphasize production for sale or exchange usually focus on one animal species while pastoralists who herd animals for subsistence purposes usually diversify their species in order to minimize risk. Sheep, goat, and cattle have different nutritional needs and are susceptible to separate diseases, so keeping some of each minimizes the potential for loss in adverse conditions. However, while modern pastoralists may focus exclusively on one species, this was probably less common in the ancient past, since mixed herds provided a range of products as well as some buffer against disease and other problems.

Just as hunter-gatherers frequently engage in exchange with farmers, so do pastoralists (Dyson-Hudson and Dyson-Hudson 1980; Salzman 1972; Spooner). Historically, pastoralists have always interacted with villagers, city dwellers, and hunter-gatherers. Transhumant pastoralists are only isolated seasonally, but even fully nomadic pastoralists are not fully isolated from surrounding populations. Pastoralists have acted as traders, moving goods between villages, or as guides for itinerant traders. Many

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pastoralists participate in market systems or in informal exchange networks. In fact, many pastoralists produce crafts from wool or animal hair for exchange. Milk products and meat are also exchanged with farmers at appropriate times. Some pastoralists work as wage labor for farmers during harvest seasons. Interaction may occur through rigid social structures (i.e., *jajmani*-like systems in South Asia) or informally on an individual or group level. Negative interactions like warfare and rustling also occur between pastoralists and surrounding populations.

Ethnographic Models—Mobility

Mobility of Hunter-gatherers

Just as subsistence practices were found to vary among contemporary hunter-gatherers, so too, did mobility patterns. Those who subsist mainly on hunting and gathering range from being entirely sedentary to living a semi-nomadic lifestyle or being completely nomadic. Just as the frequency and extant of mobility varies, so do the methods and reasons for mobility. Binford identified two main types of hunter-gatherer mobility: residential and logistical (Binford 1980). In residential mobility, the entire home base is packed up and moved to another location. The residential base provides an anchor for short-term trips to hunt and gather resources. Logistical mobility refers to these shorter activity-specific trips. Binford's research demonstrated the difference between residential and logistical mobility and provided a model for evaluating the archaeological record. Most groups of any subsistence strategy practice some form of either residential or logistical mobility, or both. Further research showed that even among hunting and gathering groups with residential mobility, there is a high degree of

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variation in terms of number of moves per year, average distance per move, and total area covered per year (Binford 1980; Kelly 1983:280-281).

In addition to hunter-gatherers, there are mobile tribal groups whose main occupation is the production of crafts or the provision of services, although they may hunt, gather, or tend a few animals on the side. These peripatetic peoples are mobile artisans. The Gadulia Lohars, nomadic iron workers of Rajasthan, are an example of this type of group (Misra 1975; P. K. Misra 1977). They travel between villages repairing and fabricating iron implements for use by villagers. In other regions of India, metal workers in brass were also itinerant until the mid-twentieth century when they settled into permanent villages (Horne 1987). Similarly, the Kotas of the Nilgiri Hills are historically artists, musicians, and craft-people who made pots, metal tools, and wood products for the other inhabitants of the region; they also helped to dispose of dead cattle and buffalo (Mandelbaum 1989:147). Currently, they mostly subsist through agriculture.

Rao argues that "commercialism," like pastoralism and hunting-gathering is a viable subsistence strategy employed by mobile groups (Rao 1987). Peripatetics include entertainers, medicine specialists, tinkerers, or traveling salesemen, although they are frequently called gypsies or vagabonds (Rao 1987:7). Rao suggests that like other nomads, peripatetics also keep to seasonal migrations (Rao 1987:4). Villagers frequently mistrust and fear peripatetics some of whom were labeled "Criminal Tribes" by the British because of these stereotypes (Hayden 1987:270).

Mobility among Pastoralists

Among pastoralists, mobility also occurs on a continuum. This ranges from sedentary village pastoralists to fully nomadic pastoralists. Many pastoralists are

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transhumant, which means they move seasonally or in response to environmental conditions. Generally village pastoralists keep only a few animals which can be pastured within a days walking distance of the village and tended by children or alternating members of the household. Sedentary village households may also be "non-practicing pastoralists" (Salzman and Galaty 1990b:18) who have previously lost their flocks or have changed subsistence strategies for other reasons, but are still known to their neighbors as pastoralists.

Both social and environmental factors affect mobility (Salzman and Galaty 1990b:14). Generally, pastoralists must move frequently to find pasture and water. Movement can be vertical—up the mountains in warm weather and down to the valleys in cold. Alternatively, mobility can be horizontal in order to follow water, pasture, and fodder. Herds in Rajasthan frequently graze on cereal stubble after fields are harvested and therefore they must follow the harvest (Kavoori 1999). However, herd movement can also be shaped by market forces, social networks, and avoidance of politically sensitive areas. Migration can also shift in response to political changes. For example, Rajasthani herders previously traveled to Sindh in their annual migrations. However, after Partition this was no longer possible, and they had to adjust their annual routes accordingly (Kavoori 1999:7).

Farmers who successfully accumulate livestock may need to become partially transhumant in order to provide for all of their livestock (Cribb 1991:16). This is because large herds require more fodder than may be locally available. In transhumant patterns, only part of a given community is usually mobile. This may be determined by gender and age lines (i.e. adult males). The adoption of transhumant patterns may also be

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influenced at the family level by the economic status or on the village level by environmental factors. Thus, transhumant patterns may vary within and between families as well as between communities (Salzman and Galaty 1990b:7). Transhumant patterns also vary diachronically. For example, in Rajasthan, monsoon timing and rainfall totals can influence the direction, length, and geographical extant of the annual movement (Fisher 1997). In fact, in Rajasthan, the percent of families migrating in any given year can fluctuate from 20% to 90%, depending on the environmental conditions including the timing and strength of the monsoon (Kavoori 1999:7).

Migrating groups tend to adopt routine routes where they hold usufruct rights to pasture and water or where they can negotiate these rights through payment or the deposition of livestock dung on fields. However, over time sometimes these routes creep in different directions, into new areas, or over longer periods of time. In times of bad drought, the herds and their keepers may not return to their home village for a few years. That is, at times, pastoralists can be expansionary (Salzman and Galaty 1990b:10).

Unlike transhumant pastoralists, nomads are comprised of communities who are permanently mobile. Like other pastoralists, nomads also keep to consistent routes where they have usufruct rights. For example, the Basseri of South Persia keep to an *il-rah* or "tribal road," which provides the right to travel and use the water and pasture during certain specified times (Barth 1961). Many groups may have the right to use the same space, but they are limited to passing through that area at different times of the year. However, Barth argues, "the fact that these rights are 'traditional' does not imply that they are immutable or even that they are not on occasion the subject of contractual agreements. Precisely because the controls on the system are a series of pressures and

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counter-pressures, both natural and inter-tribal, the system of *il-rahs* is essentially a fluid system" (Barth 1959:8). As with transhumant groups, movement patterns can shift slightly over time with great accumulations, or radically in response to immediate environmental or political pressures.

Ethnographic Models—Community and Ethnic Affiliation

This dissertation examines the relationship between the inhabitants of two sites with distinct material cultures. One of the ways that archaeologists explain variation in material culture is to equate groupings of artifact styles with ethnicity. However, there are other ways to conceptualize social groupings. One alternative model is the concept of communities.

In many ways, archaeological constructions of culture history parallel conceptions about ethnicity. Spatial variations in material culture have frequently been read as evidence for the presence of multiple ethnic groups. However, the equation of artifact style and ethnicity has been challenged. For example, MacEachern argues,

> The existence of an artifact assemblage co-varying through space or time implies that some sort of relationships between producers and consumers of the materials in question existed, but in and of itself this says little either about the nature of those relationships or about the characteristics of any human collective within which such relations were embedded (1998).

The questioning of archaeological constructions of ethnicity paralleled similar debates among cultural anthropologists. While some argue that ethnicity is a modern construct that cannot be applied to the ancient past, others suggest that ethnicity and spatial boundaries do not necessarily overlap. Others point out that identity and practices of affiliation are frequently fluid and overlapping.

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The use of the concept of technological style (Lechtman 1977) has been particularly influential in challenging simplistic models of boundaries. In her study of the Indo-Iranian borderlands, Wright has demonstrated that decorative style may vary greatly between localities and regions, but that the technological aspects of craft production can span across areas that otherwise appear to be distinct. Stark et al (1998) reached similar conclusions in their study of the Tonto Basin, Arizona, where they found stylistic evidence for distinct social groupings as well as evidence for the use of similar technologies across borders, indicating social interaction across the region.

As an alternative to the study of ethnic groups, archaeologists have turned to studying different scales of human organization. These studies differentiate between the levels of region, locality, community, and household. The concept of community is of particular interest here. Wills and Leonard define community as "a residential group whose members interact with one another on some regular basis" (Wills and Leonard 1994:xiii). They argue that communities are often conceptualized in two ways: at the level of the village (where village equals community) and at a supra-village level as political communities (Wills and Leonard 1994:xiii). It can be difficult to identify communities in the archaeological record because, "The focus on community points to a human group, not just to a place or a site. Sites sometimes constitute communities and sometimes are subsumed by them" (Nelson 1994:3). Thus, sites and communities are not always a one-to-one fit. However, Kolb and Snead argue that unlike ethnicity or membership in broadly defined groups, community is partially spatial and can be defined "in a way that has clear archaeological correlates" (1997:609). They consider community to be "a minimal, spatially defined locus of human activity that incorporates social

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reproduction, subsistence production, and self-identification" (Kolb and Snead 1997:611). Yaeger and Canuto (2000) argue for a definition of community that is less spatially defined and incorporates practice theory. Their definition provides two useful thoughts for the context of the Mewar Plain. First, they argue that communities do not require "co-residence" but do require "frequent co-presence" (2000:6). Second, they argue that, "a community is defined not just by spaces, people, and their synchronized interaction, but also by its historical context" (Yaeger and Canuto 2000:6). Finally, imagined communities can be just as important as physical communities (Anderson 1983; Isbell 2000).

Transhumant pastoralists affiliate with multiple communities. When they are away from the village, they become a temporary spatially defined community. However, they retain their affiliations with communities at home that include the entire village, their neighborhood, or other social groupings. When they travel seasonally, their village communities in many ways become "imagined."

Ethnic Affiliation and Hunter-gatherers

Hunter-gatherers or pastoralists sometimes have ethnic affiliations distinct from nearby sedentary farmers. For example, in India, hunting and gathering or pastoral groups are frequently referred to as "tribals" in distinction to farmers who traditionally belong to a "caste" group. The difference between these groups is somewhat arbitrarily delineated and only tangentially related to historical context (Béteille 1998). The categories of tribe and caste were solidified by British administrators and have political meanings and functions today—they are largely hereditary group affiliations with historic, religious, economic, and political implications (Dirks 2001). Historically, tribal

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groups have been equated with forest people and they are commonly considered to be more "wild" and even dangerous. However, many tribal groups lived in forested areas because they had been marginalized in the eras immediately prior to the colonial recordation of castes and tribes (Béteille 1998). Today, many people with tribal affiliation are agriculturalists or live in cities. However, there are still some members of tribal groups that continue older subsistence practices and maintain some level of mobility.

While the economies of hunters and farmers are intricately connected, they may belong to separate social groups. Allchin argues that, "we must think of all these settled communities against a background of Mesolithic hunting peoples extending as an ethnic and cultural continuum throughout South Asia, among which the settlements were like islands" (Allchin 1977:136).

This is not to say that socialization in the form of long-term personal relationships does not occur, but that hunters or pastoralists and farmers may belong to different communities with different social practices, and possibly different languages (Morrison 2002a; Pappu 2004). This may or may not be true for prehistoric populations at the time of incipient and early agriculture. This study examines the technologies of Gilund and Bagor at precisely this moment in Rajasthan when some hunter-gatherers first permanently settled down to practice agriculture while some did not.

Ethnic Affiliation among Pastoralists

Research among pastoralists supports the idea that regions are typically inhabited by multiple ethnic groups and that single-ethnicity culture areas do not exist (Barth

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1956). Within a given region, communities practice "mosaic co-residence," whereby each group occupies a separate ecological niche (Barth 1956:1088).

In South Asia, a number of castes and tribes identify their historical means of subsistence through their herds (or hunting and gathering) and they consider themselves to be distinct from other castes who are known to be farmers or craftsmen. While they may live within the confines of a village for part of the year, they still maintain their affiliation with other community members who are scattered throughout the region and beyond.

However, in many cases pastoral nomads do not hold a distinct ethnic identity from nearby farmers. Transhumant pastoralists, in particular, live in their home village for extended periods. Many transhumant pastoralists are only a subset of the pastoral community; the others remain at home to tend crops, or because they are too ill or old to travel. In some cases, villages are comprised of multiple ethnic communities and transhumant pastoralists who consider themselves to be distinct. In other cases, there is little difference and the practice of traveling with the herds to find new pasture is motivated by factors like size of herd (i.e., wealth) or environmental conditions. As Salzman & Galaty (1990b:17) argue, long-term interaction between groups practicing theoretically distinct modes of production blurred the distinctions of ethnic or descent lines in many cases."

Affiliations between nomadic pastoralists and farmers may be historically rooted. Spooner argues that nomadic pastoralism developed under conditions of agricultural scarcity. He writes that,

> There is reason to suspect also that nomadic pastoralism evolved at least partially in response to a situation where the population grew more rapidly

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> than the agricultural harvest. There is evidence to suggest that from the beginning nomads were outcasts from settled societies…As a general rule, pastoral nomadism has been practiced by populations that do not have access to the land, the technology, or other resources that would allow them to maintain a fixed residence (Spooner:5).

Although it does not directly address the question of ethnicity, this model presents both a historical perspective as well as a notion of hierarchy, which other models sometimes downplay or ignore.

In some ways, the question as to whether pastoralists and farmers belong to the same entity is a question of scale. At the broadest level, all interacting groups in a given region can be said to reside in the same society. Possehl sees farmers and herders as, "two aspects of an integrated whole" (1979:548). In addition, Bar Yosef and Khazanov argue that Neolithic farmers and herders of the Transjordanian Plateau "may in fact be one and the same society in which some groups specialized in agriculture, and others in pastoralism" (1992:3) a conclusion with which Kohler-Rollefson (1992) disagrees. Instead, she argues that they are two separate groups linked through exchange. While the broadest aperture of a historic lens supports the conclusion of Bar-Yosef and Khazanov, a finer zoom must identify these two entities as separate. Even if the inhabitants of each site affiliate to the same ethnic group, their separation of distance—even if for only on a seasonal basis—results in their demarcation as a distinct community, even if the community is folded within another, more broadly defined community.

Exchange in Theory

Ethnographic and historic research demonstrated that groups of people who practiced different subsistence strategies engaged in multiple forms of economic interactions. As a result, it is difficult to characterize people by subsistence strategies.

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However, to conceptualize these relationships as impersonal exchange or anonymous trade and barter, would be mistaken. That is, the "facts of the economy" are embedded within social and political institutions and should be treated as such (Polanyi, et al. 1957). Early models of such relationships examined the gift (Malinowski 1961[1922]; Mauss 1990 [1925] [1925]) reciprocity, redistribution, and exchange (Polanyi, et al. 1957) or generalized, balanced, and negative reciprocities (Sahlins 1972). Each of these models emphasizes the idea that exchange in whatever form it takes cements bonds between the giver and receiver. These bonds can be long-term and can exist between individuals as well as groups. Exchange also includes the exchange of information (Renfrew 1975).

Exchange of food or goods is embedded in broader social relations (Peterson 1978). For example, the hunting and gathering Agta and the farming Palanan have established *ibay* relationships that mediate exchange (Sinha 1972). These relationships consist of a pair of adult married males who are on friendly terms and engage in delayed exchange over the course of their lifetimes.

Similarly, the Kota of the Nilgiri Hills in India engage in a *jajmani*-type relationship with the agricultural Badagas (Mandelbaum 1989). In this system, the Kota provide their Badaga patrons with music, pots, and metal and wooden crafts throughout the year; at the time of the harvest (or weddings, and other big events), their patrons provide them with a few liters of rice. These are life-long and inherited relationships that encompass social obligations beyond the passing of goods. However, not all hunter-gatherers engage in strict relationship-based exchange; the Birhors of Central India, for example, sell rope, wooden vessels, monkey hides, honey, beeswax, and flowers in the tribal market. In the rise of the Portuguese spice trade of the 16th century, the hill peoples

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of the Malabar coast frequently entered into debt-based contracts with middlemen traders and cultivated pepper, turmeric, and cardamom to pay off their debt (Morrison 2002b). While these relationships are all historically shaped, it would seem that prehistoric relationships between hunters, pastoralists, and farmers also were embedded socially.

Exchange relationships also can be unequal. For example, exchange relationships among the mobile Raute and local farmers in Nepal are asymmetrical and based on the concept of patronage (Fortier 2001). While interacting with their more settled neighbors, hunter-gatherers frequently employ tactics to avoid assimilation and remain ethnically distinct (Fortier 2001).

Mobile groups have a special place in exchange systems since they can easily incorporate raw material locations or the workshops of specific artisans into their route of travel. Procuring and distributing goods are in fact, the main occupation of some mobile groups that are frequently labeled as hunter-gatherers or pastoralists. That is, it is the trading that sustains the group, while hunting or herding merely supplements the main occupation. Helms (1993) suggests that travelers and traders are like skilled artisans because they are "specialists of distance;" as such they are powerful and dangerous because they speak many languages and can move between the "inside" and the "outside." She argues that exchange with the "outside" may really be acquisition of the outside including all of the meanings inherent in "outside." When elites acquire goods from far away places they demonstrate control over the outside, great skill in negotiating with the outside, or a relationship with an entity that is bigger than the local community.

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Hunter-gatherers in South and Southeast Asia

From the earliest days of European missionaries, explorers, and traders, there has been a rich tradition of conducting ethnographic research among the diverse populations of South Asia. Anthropological research undertaken by the British in the nineteenth century sought to count and categorize the various castes and tribes living in even the most remote regions. Anthropological research of the last few decades has added to this catalog of information by providing an emphasis on ecology, mobility, and engagement with markets. Most importantly, these studies have documented the interconnections between hunter-gatherers and pastoral or farming communities, which is now considered to be the norm. The quantities of literature on the various hunting and gathering groups in South Asia are too vast to review completely. A selection of relevant literature is presented here to demonstrate the variety of contemporary communities who have historically practiced hunting and gathering as a major part of their livelihood. Examples of people who had previously been considered to live in isolation, subsisting solely on hunting, gathering, and fishing but who actually have histories of trading with pastoralists or farmers include the Kuruk (Cooper 1997), the Paliyans (Gardner 1972), Dhangars (Malhotra and Gadgil 1984), and the Pardhis (Nagar and Misra 1993).

In southern India, many hunting and gathering groups have lived in the Nilgiri Hills of Tamil Nadu in more recent decades. This is because the hills have remained forested and are not as conducive to agriculture as the plains which have been largely put to the plow. The Nayaka subsist by hunting and gathering as well as performing wage labor, selling forest products, and occasionally herding animals (Bird-David 1988, 1990, 1992a). Kurumbas also live in this region (Kapp and Hockings 1989). In addition to

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hunting and gathering, they provided sorcery services for other nearby residents, however, today they are mainly agriculturalists (Mandelbaum 1989). Other groups include the Hill Pandaram/Malapandaram (Morris 1977, 1982b), and the Naiken (Bird-David 1983).

In northeast India, the Birhors practice hunting, gathering, and trapping. In addition, they gather honey, beeswax, and wildflowers and make rope, wooden vessels, and drums for the market (Sinha 1972). In exchange they collect rice from villagers both in the market and in non-market relationships (Williams 1968).

Most tribal groups studied in the twentieth century lived in hill regions because the land was unsuitable for agriculture. As most cultivable land had been claimed and developed by villagers, only uncultivable land was used by those who had claimed it previously or by those who were marginalized from farming communities. One exception to this pattern is the Kanjars who live in the Gangetic plain (Nagar and Misra 1990). Although they have a history of hunting and gathering as documented by nineteenth century anthropologists, the forests have all been cleared. Kanjars continue to hunt small game found in fields. In addition, they make groundstone, collect honey and remove beehives, make straw baskets and toys, prepare skins for drums, make leaf plates and cups, brew toddy, and gather natural fiber for thread. All of these activities allow the Kanjars to engage in local markets. In addition, some Kanjars keep livestock and cultivate crops. In Pakistan, Kanjars are known as wandering entertainers (Berland 1987). They make and sell small toys and sometimes set up carnival rides or put on shows of dancing and singing or animal fighting. The women sometimes engage in begging and prostitution as well. The Kanjars have clearly altered their economic

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strategies in order to thrive in changing environmental and social conditions. Although known as hunter-gatherers, their economic strategies are actually much more complex.

The Bhils comprise a tribal group that largely resides in Rajasthan and has a history of hunting and gathering (Hooja 1994; Murty 1994). When the Rajputs ascended to power in 600 AD, they forced the Bhils to limit their range of mobility to distinct forest tracks (Hooja 1988). However, the Bhils had a special relationship with the Rajputs and provided many services for them (Grozdins Gold and Gujar 2002). Although they resided in forests and engaged in hunting and gathering, they have always performed other jobs including wage labor, serving in Rajput armies, providing guide services for hunting parties, and gathering firewood for cremations (Grozdins Gold and Gujar 2002).

Misra has documented another group of contemporary hunter-gatherers, the Van Vagaris (Misra 1990). At the time of his research there were approximately 450 members of this community who camped on fallow fields or on public lands, and moved their residence every few days. Van Vagaris watch crops, hunt and trap small animals, sell birds and honey, and sometimes beg. Although their name is similar to the nearby Bagri and Baori communities of hunter-gatherers, Misra believes that this community has a separate history.

The Bawaria of Rajasthan historically made their living from hunting and gathering until the Indian Wildlife Act was passed in 1972, rendering hunting illegal (Dutt 2004). Currently, members of this community continue to practice a highly mobile lifestyle and act as field *chowkidars* to protect crops and do wage labor in the fields. In addition they make grinding stones, and keep male breeding buffalo. The Bawaria find

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that they are often in conflict with villagers who hold negative opinions of them and do not want them to settle permanently in the vicinity.

These examples demonstrate that a wide variety of mobility and subsistence activities have been undertaken by modern hunter-gatherers and groups who trace their ancestry to hunter-gatherers. Although this list is not exhaustive, it is sufficient to highlight the degree to which hunter-gatherers have the potential to interact with their neighbors in positive and negative ways. Economic interactions between separate communities who specialize in distinct niches can be beneficial for both hunter-gatherers and villagers. In these examples, caste or tribal identity is only tenuously linked to occupation in that members of a community may undertake similar economic strategies, even though these strategies shift over time.

Pastoralists in South Asia

In Rajasthan, Raikas (or Rebaris) traditionally keep large herds and engage in seasonal migrations. They travel in *dhungs* that can include over 150 people (men, women, and children), thousands of sheep, and assorted camels, goats, and donkeys. Raika dhungs are "very nearly a 'village on the move'" (Kavoori 1999:5). Gujars are another Rajasthani caste that engages in pastoralism, although to a lesser extant than the Raikas. Gujars own more land and practice agriculture more frequently than Raikas and are "more integrated into the sedentary village community" (Kavoori 1999:5). As a result, they move less frequently and over shorter distances.

During years of good rain, migration may be kept within thirty to forty kilometers (Fisher 1997:154). However, during drought years even members of castes that keep livestock but are typically sedentary (such as Rajput, Sindhi, and Muslims) have traveled

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far distances (Fisher 1997:155). More typically, however, farmers who are members of castes without migrating traditions make arrangements with Raikas or other pastoral groups to tend their animals when sufficient pasture cannot be found close to home (Fisher 1997:155). Sometimes such animal tending occurs within the context of patronage relationships (Fisher 1997:156).

Rajasthani pastoralists usually travel outward from the arid regions of the Thar Desert in three directions: to Haryana and Uttar Pradesh, towards Madhya Pradesh, and to Gujarat. In previous years they traveled to Sindh, but this is no longer an option because they do not have permission to pass into Pakistan (Kavoori 1999). Migration begins at different times each year depending on rainfall, but it generally begins at some point after the monsoon rains have finished. If rains are sufficient, this can occur months later. In January, crops are harvested and crop residues become available for grazing. Farmers welcome herds to graze on their land after the harvest, because the herds leave behind dung which acts as a fertilizer. In fact, in many cases, farmers will pay shepherds for the privilege of keeping their sheep in their fields. Flocks begin to return home in May in order to arrive with the new monsoon by July.

Gujarati pastoralists, the Maldharis, sometimes travel into southeastern Rajasthan during their annual migrations (Swayam 2006). Maldharis include Gujjars, Kathis, Yadavas, Ahirs, Charan, Bharwad, Rabari, and Sindhi Muslims, although today only the last four groups primarily tend flocks (Swayam 2006:17). As in Rajasthan, land reform and encouraged sedentism made many groups emphasize agriculture and craft production over livestock herding. During the monsoon, adult men tend flocks in monsoon camps while the remaining members of the community live in a village and undertake

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agriculture, craft production, and wage labor. During migration season, the village is largely abandoned and entire households migrate together with the flocks.

Both Rajasthani and Gujarati pastoralists are well integrated into their home villages. In addition, they form vast networks with other pastoralists, farmers whose land they traverse, and merchants who buy their products. In addition, pastoralists engage with the state over taxation and rights to use state-owned forest land, among other issues. Pastoralists also are integrated into towns that specialize in wool procurement (Kavoori 1999:116). However, pastoralists are frequently of lower status than farmers and are subject to disparate power relations. Occasionally, pastoralists must engage in client-patron relationships with villagers. Examples of pastoralists who engage in the market include the Banjaras (Childers 1975, 2003), the Dhangars (Sontheimer 1975), and the Todas (Walker 1986).

Archaeological Examples of Interaction

Just as ethnographic and historical evidence point to the existence of various forms of trade and exchange relationships between those whose primary form of subsistence is hunting and gathering and those who primarily farm, so does the archaeological record. In North America, such relationships were common both before the contact period and after (Head and Fullagar 1997; Headland and Reid 1989; Odess 1998; Spielmann 1991).

Identifying archaeological sites as pastoral and locating pastoral peoples in the archaeological record has been challenging. Childe argued that their use of portable architecture and objects made of perishable goods meant that an evacuated camp may not leave any traces behind (Childe 1956). In South Asia, Possehl has argued that, "sites of

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this type are not represented in the inventory of Harappan settlements is probably due to a number of reasons, the most important of which are that archaeologists have not specifically looked for this kind of site and the 'fragility' of this aspect of the archaeological record" (Possehl 1979:547). In her research, Allchin also found that it was difficult to distinguish between pastoral and hunting camps because many pastoralists also hunted (Allchin 1977:139).

Ethnographic work by Cribb (1991) and others has demonstrated that pastoral camps are, in fact, visible after they have been abandoned. However, he argues that there has been insufficient methodological research that would enable archaeologists to distinguish pastoral camps from hunter-gatherer camps or villages (Cribb 1991:67). He suggests that in order to understand the archaeological record it is important to define the difference between a "nomadic campsite" and a "pastoral camp."

Cribb argues that villagers and nomads utilize many of the same household objects, however, pastoral material culture is usually comprised of lighter materials (Cribb 1991:69). His study of pottery revealed that pottery is used less intensively and tends to have a smaller range of types and sizes. In the group that he studied, large pots were left behind at sites, leaving a specific archaeological signature. Contemporary pastoralists have a high quantity of goods because they can utilize pack animals; pastoralists of the deep past may not have had such options (although goats can be used to carry small goods). Architecturally, not all housing materials are removed when camp is broken. Pastoralists sometimes build corrals from available material and these are left behind. In addition, prepared floors and platforms and hearths are left behind. When

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camping amidst archaeological ruins or abandoned villages, pastoralists sometimes use wall materials to build enclosures.

In his comparative study of farmers and herders in Southern Israel, Gilead identifies archaeological signatures of farming settlements which include: mudbrick structures, proportionately more sickle blades, a broader variety of pottery that is made of local clays, bones of domestic pigs, which cannot accompany pastoral populations, and thick occupational layers (Gilead 1992:30-33). He argues that pastoral sites did not have these traits.

Hunter-gatherer camps differ from pastoralist camps in many respects. Unlike pastoral camps which are short-term occupations usually by entire households and exhibit all household activities, some hunting and gathering camps may be activity-focused (Binford 1978). In addition, as hunter-gatherers usually do not have pack animals to carry items, they have fewer goods than pastoralists or settled villagers (Schiffer 1987). As a result, their goods must be multifunctional (see for example Kuhn 1994). Some items, especially bulky or heavy ones like grinding stones, may be cached at certain sites for use during the next stay at that site. As at pastoral camps, little time is invested in erecting solid architecture.

Beyond identifying pastoralists in the archaeological record, it is even more challenging to determine ethnic affiliation or identity. As Cribb has noted, nomads "do not constitute an archaeological 'culture' in the Childean sense" (Cribb 1991:65). However, determining whether any one site was inhabited by a specific ethnic group is troublesome. Frequently, sites like mobile camps are reoccupied by different groups (Schiffer 1987). The material remains left behind become mixed over time and can

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become one artifact assemblage. More importantly, however, is the historical pattern of transhumance and the relationship between transhumant pastoralists and villagers. While in some cases they may affiliate with separate ethnic groups, in other cases, they belong to the same community and there is no ethnic difference between mobile and settled members. Thus, classifying a camp as pastoral or hunting only identifies the activities conducted there and does not necessarily indicate the cultural affiliation of the group.

Many of these archaeological signatures were determined through study of the ethnographic record. Ethnographic analogy is both useful and limiting. Without the use of analogy it would not be possible to understand past relations between pastoralists and farmers. However, analogies used uncritically can lead to the recreation of modern realities in stories of the past. Contemporary hunter-gatherers and pastoralists negotiate the modern world (Salzman and Galaty 1990a), and live in conditions unmatched in the past. The most obvious difference is the use of modern facilities like guns for hunting or trucks for moving herds through vast expanses quickly (Kavoori 1999). However, other contemporary forces like encapsulation and habitat loss either have no parallel in the ancient past or occur on such an unprecedented scale today that their usefulness for comparison is doubtful. It is important to distinguish between those aspects of social processes and practices that ethnographic research can illuminate and those which it cannot (Wylie 2002). Most important is a recognition of the vast variation in human behavior, and the multitude of potential responses to factors like environment.

The Spread of Agriculture

The need for nuance is nowhere more urgent than in the studies of the early Holocene when domestication and farming were beginning to take root in many parts of

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the world. While this time period is described by many as the transition to agriculture, it could also be described as the incorporation of agriculture and pastoralism into a broadening repertoire of subsistence strategies. In many places in throughout the world, the "transition to agriculture" remains an incomplete project. In the sections below I review archaeological evidence for interactions in different regions, followed by an in depth consideration of South Asia.

"Mesolithic" and "Neolithic"

For many years, archaeologists separated hunter-gatherer and farming sites of the early Holocene by referring to them as either Mesolithic for the former or Neolithic for the latter. This categorization was strongly adhered to in European archaeology, where agriculture was considered to have spread as a "wave" through diffusion or colonization. In recent years there have been many attempts to rethink this dichotomy (Bailey and Whittle 2005; Zvelebil 1986) and to recognize the co-existence of multiple subsistence and mobility strategies.

In South Asia, the concept of the "Mesolithic" has a long and checkered history and there does not seem to be one standard definition (see Possehl and Rissman 1992: and discussion in Chapter 5). When reviewing the archaeological literature, it becomes apparent that two adjacent archaeological sites that were contemporaneously occupied have occasionally been given different chronological designations, for example "Mesolithic" and "Chalcolithic." The result is that potential interactions are obscured by the use of terminology. In this study, "Mesolithic" is used to define a time period of the Holocene prior to domestication. Sites of the "Mesolithic" include microlithic scatters

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and rock-shelter occupations. Bagor was initially occupied in the Mesolithic (5500-2300 BC), however, it continued to be occupied beyond that time period (2300-600 BC).

Shifting Mobility and Subsistence in the Mesolithic-Neolithic Transition

In the Mesolithic, prior to the domestication of plants and animals, humans thrived through a mixed hunting, gathering, and fishing lifestyle. Some studies have shown that early forms of horticulture may have begun during this time period. Those who gather understand the properties of plants, annual growth patterns, nurturing growth environments, and the function of seeds or shoots (Rindos 1984). It has been demonstrated that gatherers do not usually strip an area bare of resources, but leave behind enough plants so that the following year resources will be abundant. In addition, it has been suggested that during the Mesolithic people transported seeds and shoots to new areas in a form of incipient horticulture. For example, in Mesoamerica, domesticated crops formed only a small part of the subsistence base during initial agriculture (Blake, et al. 1992). Similarly, it has been argued that during this phase, people experimented with forms of a "walking larder," or capturing and raising some animals, instead of killing them immediately for food (Clutton-Brock 1989). The initial transition from hunting to herding did not require major changes in mobility or daily practices (Donahue 1992). The Mesolithic, then, was a phase where humans experimented with domestication to varying levels of success.

With the Neolithic, humans began to engage with agriculture more systematically. It is clear that in most areas some form of hunting and gathering remained an important part of subsistence strategies. In addition, with a broader range of subsistence choices that became available, different groups pursued separate paths, which ranged from nearly

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exclusive agriculture, to nearly exclusive pastoralism, to nearly exclusive hunting and gathering or fishing. However, few groups pursued one strategy exclusively and instead incorporated diverse regimes into their economies. Agriculturalists still fished or pursued annual hunts or annual nut gathering trips, for example. Pastoralists and hunter-gatherers sometimes planted crops. In order to offset the deficiencies in any one subsistence strategy, or to offset environmental shortcomings (drought years, etc.), people most likely exchanged food items with others during this time.

In the Near East, where agriculture is thought to have originated, there is evidence that multiple settlements simultaneously, or nearly simultaneously took up agriculture and produced a range of crops. However, even in this area, many hunting and gathering groups continued to rely on their traditional subsistence strategies, and only engaged in agriculture in limited ways (Byrd 1992). Multiple subsistence strategies may have been undertaken within nearby regions and exchange of crafts and domesticated foods for wild products likely occurred in the Levant (Bar-Yosef and Belfer-Cohen 1991). Such interactions continued in the Levant through the Bronze Age and beyond (Rosen 2003). They were also common in Mesopotamia where there appears to have been upland-lowland interaction (Potts 1982).

While there are competing theories for the way in which agriculture spread through Europe (versus colonization Ammerman and Cavalli-Sforza 1984; diffusion Gebauer and Price 1992), it is clear that during the course of several centuries those who made their living primarily through hunting and gathering lived side-by-side with farmers. In northern Europe the transition to a fully agricultural society was "long and slow" (Price and Gebauer 1992). This process occurred over centuries, during which

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communities from sites with different subsistence practices continued to interact and engage in exchange, and warfare (Keeley 1992). Similarly, the temporal boundary between Mesolithic and Neolithic Greece has been seen as a false dichotomy since there was substantial overlap in subsistence and mobility practices during the transition phase. Kotsakis (2005) argues that as agriculture spread, hunters and farmers interacted in multiple "frontier zones." In these areas, the inhabitants created "an active social dynamic" (Kotsakis 2005:12). In fact, such interactions between food producers and food collectors may have greatly influenced food production strategies (Gregg 1991). In the Pyrenees, such interactions occurred between uplands and lowlands (Geddes 1983).

In many regions of the Southwest of the United States, early farmers were sedentary only seasonally. In the non-agricultural seasons, many communities reclaimed a mobile lifestyle which included hunting and gathering (Stone and Bostwick 1996; Wills 1988). Seasonal mobility allowed early farmers to take advantage of two ecological zones: lowland fertile plains and upland areas rich in game animals and piñon (Roth 1996). It is important to keep in mind that sedentism is one end of a mobility spectrum (Kelly 1983, 1985 1992). In the Neolithic even sedentary agriculturalists were somewhat mobile and engaged in some hunting, gathering, or pastoral activities (Bailey and Whittle 2005).

South Asia

The transition to agriculture in South Asia, like that in northern Europe, can be described as "long and slow." While some domesticated plants and animals were brought to the subcontinent from elsewhere, others were domesticated on-site. Pastoralism seems to have preceded sedentary agriculture and the two subsistence strategies have co-existed

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from their origins through the present day. Both early and recent farmers and herders utilized both domesticated and wild plants and animals, although hunting in recent years has become more difficult with the imposition of legal restrictions and the shrinking of wildlife areas. In addition, until recent times, pockets of people who subsisted solely or mainly on hunting and gathering paired with wage labor and trade and exchange, could be found all over the subcontinent.

Mehrgarh in present day Pakistan presents the best evidence for early domestication and adoption of domesticates in South Asia. It appears that barley and wheat were already domesticated when they were first used in South Asia (Meadow 1996). These then spread to the rest of the subcontinent. Other summer crops like peas, lentils, and flax, also appear to have been domesticated in before reaching South Asia. Little millet was likely domesticated in South Asia, as were cotton, gram bean, and dates (Meadow 1996:396). Although wild rice was collected prior to the third millennium (Meadow 1996:399), domesticated rice likely came from Southeast Asia (Glover and Higham 1996). Goats had been domesticated at Mehrgarh by period IA. Cattle (*Bos indicus*) seems to have been domesticated in South Asia, as was the water buffalo. Sheep, horses, donkeys, and camels seem to have been domesticated to the west and then brought to the subcontinent (Meadow 1996:403-5).

In Western India, the sites of the Ahar-Banas Cultural Complex represent the first farming communities in this region. In this region in the first few millennium BC there is considerable evidence for sites of contemporaneous sedentary and mobile people, as well as those who practiced mixed agro-pastoralism or hunting-gathering-pastoralism.

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Evidence suggests that these groups interacted through exchange relationships. Hooja (1996) argues that such regions of interaction should be considered to be frontiers.

While agriculture, pastoralism, and sedentism were widely adopted from the third to second millennium BC in South Asia, there is evidence that many groups continued to hunt, gather, and live a mobile lifestyle. The archaeological record is clear on this (see below for discussion). In addition, the historical record, from the earliest recorded documents, through contemporary studies, show that South Asia has always been home to multiple communities who practice different (and sometimes multiple) types of subsistence strategies and levels of mobility.

Archaeological Examples of Interaction in India

In South Asia, there are at least 20 excavated and published temporary habitations of hunter-gatherers or pastoralists that were occupied after the rise of agriculture. Hundreds of similar sites have been identified through survey (Cooper 1997; Hooja 1988). Among the excavated temporary habitations, the following produced evidence of contact with their settled neighbors: camps near Harappa (Mughal 1994), Langhnaj (Pandya, et al. 1990; Possehl 1992a, 2002a; Possehl and Kennedy 1979), Oriyo Timbo (Reddy 1991; Rissman and Chitalwala 1990), Dhansura (Wakankar 1976), Bhimbetka (Lukacs 2002; Lukacs and Pal 1993; V. N. Misra, Nathpal, Yashodar, Nagar, Malti 1977), Kanavaypatti (Selvakumar 2002), E. Gopalapuram (Selvakumar 2002), Virapatti (Selvakumar 2002), S. Pappinayakkanpatti (Sankalia 1969a; Subbarao 1948), Sanganakal (Pappu 2004) and Bagor (Leshnik 1968, 1972; Lukacs 1990, 2002; Misra 1970, 1971a, b, 1973). Other sites that may potentially fall into this category include Pushkar (Pappu 2004), Ganeshwar (Possehl 1974, 1976), and Raisen-Sehore (Jacobson 1985). At these

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sites the presence of metal artifacts, distinctive pottery, or beads, was taken as evidence of interaction since these items are presumed to be manufactured in contemporaneous nearby villages. In addition to the archaeological evidence for such interactions, Allchin points out that, "literary sources suggest a continuous and well-established relationship between communities at different cultural and technological levels, sometimes close enough to be described as symbiotic" (Allchin and Allchin 1974:48). Guha (1994) argues that the contribution of hunter-gatherers to broader Harappan society should not be underestimated or ignored.

Evidence in the Indus suggests that the inhabitants of farming settlements and cities interacted regularly with nomadic pastoralists. Mughal (1994) argues that immediately prior to the Early Harappan, most settlements in Cholistan, an arid region, were camps of nomadic pastoralists. While the percentage of pastoral camps declined in the Early Harappan period, they rose again in the Mature and Late Harappan periods, when they comprised about 26% of all known sites (Mughal 1994:60). Mughal hypothesizes that the pastoralists may have provided services and transportation to the permanent settlements of the region, as well as meat and secondary animal products. Allchin also writes,

> We have already pointed out how nomadic herdsmen form an important element of rural life in India and Pakistan today, including the old province of the Harappan culture. There is every reason to suppose that they did so in Harappan times, and that they played an important part in the economy and organization of the Harappan world. In the same way there is every reason to suppose that relations with both hunting and herding communities played an important part in the life of the early settlements of the Deccan and South India. The similarity of the blade traditions of Mesolithic hunters and settled peoples clearly indicates this, and there are other indications of contact in rock art, material culture and animal remains at many sites, and as we have indicated, modern practice accords with the archaeological record" (Allchin 1977:139).

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Other studies of third millennium South Asia have indicated that the Indus was a diverse society comprised of multiple ethnic groups (Shaffer and Lichtenstein 1989).

Langhnaj is located near the trading center of Lothal, a large Chalcolithic town that engaged in high levels of intraregional and interregional trade (Possehl 1976; Rao 1979). The site was occupied by "hunter-fisher folk" in the third millennium BC (Sankalia 1965:8). While no architectural remains were detectable at this site (IAR 1953-54a, 1963-64a; Sankalia 1965), thousands of lithics were retrieved (Sankalia 1965:28-32; Zeuner 1952), along with ten species of wild animals (Clutton-Brock 1965). At Langhnaj, three major classes of artifacts are presumed to have been acquired from nearby farming villages and towns like Lothal. These include a copper knife, distinctive Black and Red Ware pottery resembling that from Lothal, and disk beads that resemble Harappan disk beads (Sankalia 1965-19). Sankalia argues that, "The occurrence of bits of pottery with burnished black interior and red slipped exterior suggests that the microlithic man of Langhnaj had established contacts with cultures using this pottery—such as Saurashtra, Rajasthan and the Deccan" (Sankalia 1965:17). He also suggests that, "The copper knife again should be an import from Rajasthan, probably eastern Rajasthan, or made from the ore from this region" (Sankalia 1965:19). Possehl has argued that the mobility of the hunter-gatherers of Langhnaj placed them in a unique position to act as traders, bringing forest products into the gateway city of Lothal (Possehl 2002a). Possehl and Kennedy write that, "typological parallels, the location of Lothal, and the scale of the manufacturing processes there very positively suggest that among the groups involved in collecting raw materials for Lothal were hunter-gatherers of the North Gujarat Plain such as those at Langhnaj" (Possehl and Kennedy 1979:593). While evidence of such artifacts

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was not retrieved from Lothal, it is possible that the inhabitants of Langhnaj provided goods that do not leave a trace in the archaeological record or that are not necessarily identifiable as imports (such as meat, baskets, rope, honey, wax, etc).

Studies of the 14 human burials at Langhnaj are also suggestive (Ehrhardt and Kennedy 1965; Karve and Kurulkar 1945; Walimbe and Kulkarni 1993). While the teeth of one skeleton were quite worn from a coarse diet, another skeleton had dental carries (Ehrhardt and Kennedy 1965:46). Worn teeth are expected among hunting and gathering populations, however, dental carries indicate that the inhabitants had a mixed diet that may have included high carbohydrate agricultural foods. Lukacs suggests that the dental carries rate of 8.0% is much higher than the dental carries rates recorded at other sites of ancient hunter-gatherers (Lukacs 1990). He argues that this “may be attributed to the periodic inclusion of agricultural foodstuffs in the Langhnaj diet” (Lukacs 1990:183).

Ehrhardt also suggests that the physical traits of the Langhnaj skeletons are bimodally distributed (Ehrhardt and Kennedy 1965:46). However, she pointedly remarks that, “The condition of the bones was on the whole bad,” and that they were smashed both at death and from the weight of soil, and deteriorated (Ehrhardt and Kennedy 1965:3). She notes that, “The tedious work of putting together the various small pieces and reconstructing” was done by Karve 12-15 years prior to her examination of the collections and as a result of the reconstructions, and post-excavation damage, she disagreed with some of Karve’s original conclusions (Ehrhardt and Kennedy 1965:3; Karve-Corvinus and Kennedy 1964; Karve and Kurulkar 1945).

Skeletons also were retrieved from the site of Lothal. A total of 19 skeletons were studied, although more were recovered from the excavation (Rao 1979:137). Possehl and

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Kennedy argue that the skeletons from Lothal have a "high degree of phenotypic heterogeneity in the skeletal biology of the Lothal population" (1979:593). In addition, the skeletal analysis supports the idea of "a regular gene flow between the Harappan and hunting-gathering populations in prehistoric Gujarat" (1979:593). The skeletons do not resemble those from the Indus region (Kennedy 2000:235). Kennedy et al's craniometric study of skeletons from Lothal and Langhnaj also supports this conclusion (1984).

In contrast to the Langhnaj skeletons, the single Phase I skeleton from Bagor, a young adult female, had teeth that were little worn; however, the age of the skeleton suggests that sufficient time had not passed to evidence worn teeth (Lukacs 1982:81). One of the three skeletons that were contemporaneous with both Langhnaj and Gilund also had very bad dental caries, indicating that carbohydrates were consumed regularly. The other two skeletons consisted of a child and an adult with missing teeth (Lukacs 1982:82). The skeleton of the adult female and the child were poorly preserved and a full metrical and morphological analysis was not possible (Kennedy 1982:34). The adult male was described as having a "relatively large, narrow and high cranial vault" (Kennedy 1982:43) and "robust muscular development" (Kennedy 1982:44). It should be noted that Kennedy does not explicitly link the Bagor and Langhnaj skeletons, nor does he link the Bagor skeleton to any other contemporaneous population.

The biological evidence from these sites has been instrumental in the development of frameworks that explain the relationship between Langhnaj and Lothal. The dental evidence from Bagor, although from one specimen, mirrors the dental evidence from Langhnaj and suggests that the inhabitants of Bagor may have been obtaining cereals from Ahar-Banas sites. However, the skeletal evidence is less helpful.

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The low number of skeletons and their poor condition present a problem. In addition, the only skeletons that have been recovered from Ahar-Banas sites are five skeletons from Balathal. In their analysis of these skeletons, Robbins et al argue that, "the sample size is small, and thus no paleodemogaphy or biodistance studies will be attempted" (Robbins, et al. 2005:6). As a result, it is not possible to compare the Bagor and Balathal skeletons. While the skeletal evidence does not rule out an intimate relationship between the inhabitants of Bagor and the Ahar-Banas sites, it also cannot support this model. At best, the biological evidence is ambiguous.

Gilund and Bagor

Drawing from these frameworks, it is suggested here that the relationships between the inhabitants of sites like Gilund and Bagor were likely the continuation of long-term shared histories. While exchange among pre-agricultural groups of the fifth millennium BC Rajasthan has yet to be investigated, it is likely that such practices occurred. With the onset of farming and pastoralism in the third millennium BC, previously established relationships would have shifted to take into account the new mobility and subsistence strategies employed by some communities as well as the production of new crafts. Review of the ethnographic literature on hunter-gatherers and pastoralists present two different models for describing regional interaction in the Mewar Plain in the third and second millennium BC.

A review of the ethnographic literature on hunter-gatherers suggests that the relationship may have been structured around exchange. Villagers like those from Gilund could offer crafts and domesticated foods in exchange for wild foods or crafts made from wild materials by foragers who inhabited sites like Bagor. Such exchange

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relationships may have begun before the first divergence in subsistence strategies, but shifted in the new context. Exchange may have occurred intermittently or sporadically and did not necessarily entail the formation or continuation of deeper more sustained relationships.

Examining the literature on pastoralism presents an alternative scenario in which the inhabitants of sites like Bagor resided in temporary communities due to practices of transhumance. In this scenario, they would have lived in nearby villages like Gilund for much of the year and only left in dry seasons or when rain was insufficient to produce enough fodder for flocks. They resided as a distinct community, yet retained ties to their home village. During their time away from home they supplemented their diet with grains and foods brought from home as well as wild foods that were hunted and gathered. They would have also brought a few craft items from home such as bead jewelry and pottery.

Evidence that these relationships occurred earlier than the third millennium BC and ran deeper than anonymous exchange can be tested by looking for evidence of shared technology. As will be presented in the coming chapters, the inhabitants of Gilund and Bagor shared a common lithic technology that is somewhat unique to this region and different in some regards from areas to the north (such as the Indus) and the south (such as the Deccan). Since stone knapping and blade technology is a learned skill, it is likely that these communities shared knapping knowledge from the time of the earliest occupations at Gilund, and possibly even prior to that time.

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Conclusion

The goal of this chapter has been to present the ethnographic research on hunter-gatherers that has served as the model for understanding interaction between mobile and settled communities in the third and second millennium BC. Ethnographic research on pastoralists has been presented as an alternative model for interaction. Both hunter-gatherers and pastoralists practice mobility on a continuum, which can vary over time. In addition, it is clear that subsistence practices themselves can overlap and shift over time. Interaction and exchange with neighbors can occur regardless of a group's subsistence or mobility practices; in fact, subsistence practices may provide opportunities for exchange with others.

While it is common shorthand to refer to sites such as Gilund as early farming settlements, agricultural settlements, or even agro-pastoral settlements, such designations are perhaps a bit misleading. The tri-partite division of society into agriculturalists, pastoralists, and hunter-gatherers is a tidy way to explain human occupations and lifeways, and it quickly communicates a great deal of information including levels of mobility, food production and consumption patterns, and also perhaps social organization. However, the ethnographic and archaeological literature clearly demonstrates that most communities practice some form of mixed subsistence economies. That is, farmers throughout history have still hunted, fished, and gathered, and may have spent some or part of the year away from the village tending to flocks, gathering seasonal foods, or hunting. Hunter-gatherers similarly sometimes grow crops or keep a few animals; they may be seasonally or permanently sedentary. Pastoralists may live in a farming village for part of the year with family members, and hunt while

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their animals graze in the pastures. In many ways, the tripartite shorthand that archaeologists developed to help convey a description of the people that they study can actually interfere with our understanding of the mixed nature of subsistence strategies. The split between farmer and hunter was created by the Western imagination which sees a world of difference between a farmer and a hunter—one is tame, one is wild; one is civilized, the other not (Pluciennik 2001). By dividing humans into three groups, it is easier to imagine social and physical barriers between them, barriers that in many cases never existed.

The relationship between subsistence and mobility is not necessarily fixed. Subsistence practices may also vary based on climatic conditions, such as prolonged drought. Ethnographers also found that crafts are produced by those who practice any subsistence strategy and that craft production can also provide a large part of the economies of hunter-gatherers (Headland and Reid 1989) or even pastoralists. In sum, subsistence should be seen as only one aspect of broader economic strategies and practices.

It should be reiterated that ethnicity or cultural affiliation are not necessarily tied to mobility or subsistence which change over time. In fact, it is common for individual households within given culturally defined groups to engage with pastoralism, hunting, and mobility at different rates. As a result, parts of a village or community group may travel to other regions for part of the year to hunt, gather specific foods, or provide pasture for herds. In these scenarios, hunting or pastoral camps are even more tightly connected to nearby villages, which are their homes for part of the year. Seasonal trips to other destinations however, mark traveling communities as separate communities. While

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they may not be ethnically distinct, transhumant villagers should be seen as a separate community, at least for the duration of their trip. While the evidence from Gilund and Bagor suggest that they were inhabited by different communities, it is more difficult to determine if they are separate "groups" in the traditional sense.

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Chapter 4. Lithics

Introduction

In comparing Gilund and Bagor, this project combines multiple avenues of research including the identification of potential sources for lithic raw material procurement, lithic assemblage variation, and methods of core production. By following these pathways, it was possible to consider whether the inhabitants of these sites utilized the same raw material sources, engaged in the same daily practices, and shared a common skill set. In order to contextualize the analysis that was undertaken, this chapter reviews the archaeological literature of lithic technology including the ways that lithic assemblages are shaped by mobility, subsistence and other economic activities, as well as raw material procurement, and skill acquisition and transmission. As cores hold manufacturing signatures that indicate technological practices, various aspects of core production are reviewed here including platforms, initiation, raw material, intensity of use, technique, desired end product, reason for discard, and final core shape. Finally, the concept of technological practices is situated within a broader cultural framework.

Lithic Assemblage Variability

Mobility and Sedentism

Archaeologists have long studied how the lithic assemblages of sedentary and mobile groups differ. Many studies have examined specific methods that can be used to identify mobility (Morrow 1996:50) or explain assemblage variation due to mobility

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(Brantingham, et al. 2000; Cowan 1999; Kuhn 1994; Odell 1996, 1998; Parry and Kelly 1987; Shott 1986; Wallace and Shea 2006). Middens of permanent settlements gather more lithics than temporary camps, due to length of occupation. In addition, highly mobile people own fewer items than sedentary people who can rely on storage. As a result, highly mobile people must be able to call on their few tools to perform multiple and various tasks. In contrast, sedentary people can stash many tools in their house for future use. Because they have multiple lithics from which to select, sedentary people have the freedom to make specialized tools that may only be used for restricted tasks. Thus, mobility affects lithic assemblages through the ratio of tools to non-tools (Shott 1986). In sum, higher mobility has been interpreted to mean fewer, more flexible tools (Shott 1986).

Comparing the lithic assemblages of North American sites in the Holocene, Parry and Kelley (1987) found that over time formal tools such as bifaces decreased and informal or expedient tools such as unretouched flakes increased. Rejecting the concept of devolution, as well as any association with agriculture, they found that expediency was linked only to sedentism. They argue that bifaces are highly efficient and portable and therefore excellent resources for those who are on the move and with intermittent access to raw material. However, they point out that bifaces require more effort to maintain and also require good quality material that may also take more effort to obtain than local materials. Bifaces are more flexible and durable for cutting, but are not as sharp or specialized as an expedient flake made with a specific task in mind. Those who lead more sedentary lives, on the other hand, can store unworked and worked stone and therefore do not need to manufacture items in a way that conserves material. Therefore,

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sedentary people can be less concerned about portability, efficiency, and flexibility, and raw material quality. They can use materials of lesser quality in inefficient ways. Levels of mobility or sedentism can vary greatly within a single region or over time and therefore the organization of lithic technology also varies (Cowan 1999).

The assumption that highly mobile people desire tools with high portability and utility was examined by Kuhn through a series of experiments (1994). In his search for the ideal mobile toolkit, he found that the ideal lightweight versatile toolkit consists of a few small flakes or flake tools rather than one large lithic; however if only one lithic is transported, then a core is the best (highest mass to utility ratio) option. It seems that in most cases in prehistory, however, people were not limited to carrying a single lithic.

Much of the evaluation of mobility strategies focuses on the concept of expedient versus formal technologies. However, Nelson (1991) provides a third category: opportunistic, which refers to lithics that are made with little to no preparation. Blade cores are considered to be formal technologies, although blades can be made quite expediently once the core is prepared.

The studies of Parry and Kelly and Shott were based on biface technology, which is technologically very different from blade technology used in India from the Upper Paleolithic onwards. Like bifaces, blade cores are flexible formal technologies. Multiple tool forms can be produced from blades and blade cores. Lunates, triangles, backed bladelets, transverse arrowheads, and many other tools all begin as a single blade removed from a blade core. It is only after the blade is produced that specific tools are fashioned by distinct sequences of snapping and backing. Variation among blade tools produces miniscule differences in weight that do not affect portability, a key

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characteristic important to mobility. Thus, blade cores offer the flexibility of bifaces, but do not curtail the creation of formal tools. In fact, Parry has suggested elsewhere that blade cores are portable, efficient and highly suitable for the conditions of mobility although they are clearly used by both mobile and non-mobile populations (Parry 1994:93).

Blade and bladelet technologies developed in the late Paleolithic all over the world (Kuhn and Elston 2002:2). The development of flexible and portable blade core technology may actually be related to increased mobility in the late Pleistocene. Blades have a very high cutting edge to raw material ratio, and therefore make very efficient use of raw material (Sheets and Muto 1972). In addition, since microliths can be made rapidly and composite tools are highly efficient, they together offer a flexible technological solution for highly mobile people (Neeley 2002:50). Blade core technology and the composite tools made from blades are "maintainable" (Bleed 1986). That is, composite tools are easy to repair since it takes little effort to pop out a broken element and slide in the new replacement part. The maintenance time and scheduling of repair activities are important considerations in the lithic technology of mobile people (Torrence 1983). Such easy-to-fix tools are highly useful to those who are always on-the-go. In addition to formal tools fashioned from microblades, wedge-shape cores doubled as knives and were thus a highly flexible tool for mobile peoples in Siberia in the late Upper Paleolithic (Goebel 2002).

When considering portable tool-kits, it is also important to differentiate between mobile people with different subsistence strategies. Hunter-gatherers and pastoralists not only undertake varying tasks, but the latter has access to pack animals. Goats, sheep, or

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other domestic animals can easily carry items and lighten the burden for people (Close 1996). While some animals can not carry heavy bundles on their back or around their neck, they can certainly expand the carrying capacity of any mobile group. This has the dual result that the ratio of formal and informal tools as well as raw material may vary between pastoralists and hunter-gatherers because there is less of a need to work stone efficiently, and it also allows more materials to be carried further from their source (Close 1996).

While studies that compare the lithic use of mobile and settled groups are informative, it should be cautioned that in many ways the sedentary-mobile dichotomy is somewhat misleading (Kelly 1992). Farmers leave the village regularly as part of daily work and social routines. They also make seasonal trips for hunting, resource acquisition, ritual performance, exchange, and social interaction. Pastoralists and foragers also range in their degree of mobility and may shift camp on a daily basis or as little as once a year. These patterns may change in response to drought or environmental concerns as well as disease, warfare, and extra-annual religious or social cycles. Mobility and sedentism should be considered on a continuum; all human groups use a diverse strategy that varies from day to day and year to year (see Chapter 3 for an elaboration).

Subsistence and Other Practices

In addition to mobility, many other factors, like subsistence practices and other economic activities that require lithic tools, affect lithic production. Sometimes mobility closely parallels subsistence practices. That is, mobile people frequently subsist through hunting or tending animals and settled people tend to emphasize agriculture and craft

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production (although see Chapter 3 for a discussion of exceptions to this dichotomy). Hunters, pastoralists, and farmers all engage in different types of daily activities related to their subsistence goals. Some of these activities may overlap, but others are quite distinct. However, some activities are performed by all groups. For example, all groups in a given region may whittle wood and shave. But sedentary farmers are much less likely to hunt regularly (and when they do, they may deposit their hunting lithics at temporary camps), just as hunter-gatherer/pastoralists are much less likely to intensely harvest cereals or engage in large-scale craft production since storing and transporting large quantities of raw material, tools, and finished products is difficult. Some crafts, like shell-working or steatite production, require specialized lithics. The difference is frequently one of degree rather than kind. For example, it is expected that more sickle blades and craft-making drills will be found at sedentary sites because of the farming and craft production conducted there. Similarly, more arrowheads and hunting implements are likely to be found at camps of hunters. Activities that require the use of lithics, then, may vary between groups not just because of their levels of mobility, but because of their broader economic activities.

Odell's study of New World lithics (1996) also found that sedentism led to a decrease in bifaces and an increase in both projectile points and expedient technology. However, he associates these changes with shifts in activity patterns. Through use wear analysis Odell found an increase in drilling (for bead making and shell working), chopping (for land clearing), and projectile use (Odell 1998). Cutting and shaving proportionally decreased, but he suggests that perhaps these activities merely stayed static as the other activities increased (Odell 1998). Thus, it is not the lack of mobility that

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changes assemblages, but differences in activities between mobile and settled societies that may affect lithic assemblages (see also Nelson 1991: and Henry 1989).

Raw Material Acquisition

Raw material procurement is the first step in both craft (Costin 1991) and tool production and must be understood as intricately connected to tool production and use; that is, "Raw material procurement and organization of technology are mutually codependent" (Odell 2001:67). This is because, "mobility simultaneously dictates tool needs and access to raw material" (Kelly 1988:718). Lewis Binford, through ethnoarchaeological research, provided one of the first models to explain raw material acquisition among mobile groups (Binford 1979). He argued that it is inefficient to make special trips for the sole purpose of procuring raw material. Instead, the chore of procurement is most likely to be accomplished in the course of regular movements. Raw material procurement is embedded in the routines of hunter-gatherers such that it is merely one of a number of tasks that will be accomplished in a given time frame. Rather than creating a new path to procure material, hunter-gatherers are more likely to select materials encountered in the currently used paths.

Binford's framework has proven to be very useful for a wide range of archaeological circumstances. Unfortunately, the concept of embeddedness is subject to many of the weakness of optimization theory. It assumes that humans have perfect knowledge of sources and distances and that they will make the optimal choice to use the nearest source. In addition, it discounts other factors in decision making such as raw material quality (Gould and Saggers 1985) and changes in quantity (Dibble 1991). Some

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lithics may be considered to hold special spiritual powers or meaning, which can create an incentive to make a special trip (Gould and Saggers 1985). Similarly, certain materials may come from sources that are considered to be powerful in a negative way (i.e. bad luck). If such sources are encountered in the course of everyday activities, then the stone is likely to be left behind.

Just as raw material properties affect lithic production, so do raw material acquisition strategies. High quality raw material that is located at far-away sources may be used more intensively, or for specific tools. When raw material is plentiful and located nearby, it may not be used as intensively. Good cores made of hard-to-obtain high quality raw material are often used and rejuvenated until it is no longer possible to retrieve any blades from them. Cores made of locally available material are less likely to be used up entirely and are more likely to be thrown away after fewer removals. These strategies affect core shape.

In an effort to evaluate the relationship of raw material, mobility, and expediency, Andrefsky studied three regions in North America that had both mobile and settled populations: an area rich in good quality material, an area rich in bad quality material, and an area poor in bad quality material (Andrefsky 1994). In contrast to Parry and Kelly (1987), Andrefsky found that there is no association between mobility and expediency or formality in tool manufacture. Instead, his results suggest that quantity and quality of locally available raw material greatly influences a lithic assemblage. Sites located in regions with low quality raw material tend to have more informal tools while sites located in regions with high quality raw material usually have more formal tools. When there is an abundance of high quality raw materials, both formal and informal tools will be found.

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Brantingham et al (2000) also examine the quantity and quality of available raw material. They suggest that formal technology is commonly found at sites with low abundance of high quality material, but that informal technologies are more common at sites with low quality material, whether this material is plentiful or not. Sites with plentiful amounts of high quality material exhibit both formal and informal technologies.

The results of these studies have interesting implications for the lithics at Gilund and Bagor. Both are located near abundant resources of poor quality stone: quartz. As a result, according to the above models, the lithic technology at both sites should have more informal than formal tools. As will be shown in Chapter 7, this is not the case at either Gilund or Bagor. While these studies may accurately reflect strategies for formal technology based on biface reduction, it may not hold true for blade production. In addition, Andrefsky's study did not include mobile and sedentary groups that were both contemporaneous and in the same region. Instead, his study compresses multiple time periods and regions into one analysis. However, homogeneity of lithic assemblages between regions and time periods should not be assumed (Stafford 1999). The comparison between Gilund and Bagor provides an opportunity to examine contemporaneous and proximal sites.

Levels of mobility also affect distribution of raw material within an assemblage since sedentary people do not always have regular access to quarries. Sometimes sites are located near excellent sources of stone, but when this is not the case, arrangements must be made to acquire stone through other means. In many societies stone was procured through exchange. This is true for societies in stone-poor regions like the Indus, Mesopotamia, and the Mississippi bottoms. Procuring stone through trade and exchange

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certainly affects the way that stone tools are produced since excess weight must be removed prior to transport in order to maximize the usable stone transported. Procurement through trade and exchange also affects the way lithics are utilized because it turns them into commodities. As such, access to some raw materials can be limited to some segments of society.

Levels of mobility also influence access to non-stone raw materials used in tool production, like copper. This is important to Gilund and Bagor, both of which utilized copper implements. In historic periods, mobile hunter-gatherers have acted as suppliers of raw materials, like ore, to permanent settlements (Fox 1969; Hutterer 1977a; Junker 2002; Morrison 2002c). Their mobility allows them to visit more locations that may have raw materials and also allows them to enter multiple settlements in order to exchange. There is some evidence of such arrangements in the archaeological record. Thus, mobile groups may have easier access to copper ore than sedentary groups that do not live within the immediate vicinity of ore. However, mobile groups may not have the ability to smelt at all campsites. In addition, sedentary villagers may have greater access to resources with which they can acquire copper objects and tools than mobile groups. This disparity influences the lithic assemblages of each group. In many cases, copper can take the place of a stone implement, although this technological transition during the early days of copper was by no means universal or straightforward (Rosen 1997; Rosen 1984, 1996).

The question of available alternative tool materials is only one factor that influences lithic production after metals become available. In the New World, stone tools continued to be used for several hundred years after iron became available. In fact, instead of reducing stone tool production, contact with Europeans increased stone scraper

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production among those groups who participated in the burgeoning deer skin trade (Johnson 1997). Those who lived on the fringes of European contact used more stone than metal, but tended to replace stone tools selectively (Bayman 2003; Carmody 2003). That is, stone axes, which are time consuming to make and work less efficiently than metal axes were replaced quickly, as were drills, gravers and knives, which tend to break easily (Odell 2003). Native peoples continued to prefer stone for points and scrapers since they less time consuming to produce and in some cases perform better than metal (Odell 2003). Stone tool production may also have continued as a form of resistance and identity formation among Indians who lived in missions (Silliman 2003).

Interplay of Multiple Factors

Just as it is difficult to divorce mobility from factors such as subsistence, raw material acquisition, and group membership, it is difficult to isolate individual factors that influence tool design and assemblage variability. That is, multiple factors go into making an assemblage and mobility is just one of them. Bamforth cautions that, "specific technological strategies are not determined by any single characteristic of a society's way of life, but by the interactions between any factors and the environment that society inhabits. The links between technology and any single conditioner, then, are likely to be complex and indirect" (Bamforth 1991:217). Morrow also argues that lithic technology is influenced by three variables: raw material, mobility, and exchange (Morrow 1997:53). This argument is also discussed by others (Fisher and Eriksen 2002; Kuhn 1991; Rolland and Dibble 1990).

While archaeologists have long assumed that there must be some difference between assemblages due to factors such as varying levels of mobility, subsistence

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practices, craft production and exchange, this may not always be the case. A study of the Santa Ynez Valley in California reviewed 23 sites in three ecozones, over the course of three time periods (from 8000 BC through 1800 AD) and found no significant differences in the lithic assemblages (Bamforth 1991). This extended time period began prior to the advent of agriculture and continued into the modern era, which means that it includes substantial variation in subsistence, site use, and cultural context. "Perhaps the most striking aspect of the data considered here is the uniformity of the lithic assemblages in the sample. Despite fairly clear evidence for substantial cultural change on the central coast in general, despite the range of diversity in site structure and contents that can be identified, and despite the likelihood that the sites investigated here represent more than one pattern of human activity, the same kinds of tools were made and used for the same kinds of tasks at all of the sites examined" (Bamforth 1991:230).

Walker and Schiffer (2006) also argue that multiple factors influence technology. They suggest that one way to map these influences is to create a performance-preference matrix in which the performance capacities of various technological alternatives are compared against the range of preferences sought by those who utilize the technology. By creating such a matrix it is possible to transcend single-factor cause and effect models.

Raw Material

As mentioned above, the properties of raw material, including proximity and quality of raw stone, influences lithic assemblages in multiple ways. In this section I will review the various aspects of the most common kinds of stone available in southeastern Rajasthan –quartz, chert, and chalcedony—and describe how they influence lithic form.

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The most abundant stone material available in southeastern Rajasthan is quartz. Quartz crystals form irregularly, and it therefore tends to fracture unevenly. While there are different levels of quality in quartz, most of it tends to be difficult to control while knapping. The direction of force from a blow is not always predictable because of the interceding fracture planes. As a result, quartz is frequently a material of last resort for knappers who are making prepared tools of specific shapes. Chert and chalcedony are much easier to manipulate in the process of tool-making, and all things being equal are more likely to be favored for particular tools. On the other hand, if the knapper is making expedient flakes and informal tools, quartz is perfectly sufficient and can provide an acceptable sharp edge. Milky quartz or quartz with larger crystals tends to be more difficult to manipulate than more fine-grained quartz crystal. The smaller the crystal, the more predictable the outcome will be when striking a blow. In Southeastern Rajasthan, the quartz varies quite a bit from coarse and milky to fine and crystal-like. Most of the quartz available near Gilund more closely resembles the former while most of that near Bagor resembles the latter.

In contrast to quartz, chert fractures in very predictable ways and is an excellent material for blade manufacture (Luedtke 1992). Chert also responds well to heat treatment, which can increase the predictability of fracture. Chert varies in color, translucence, luster, and inclusions and also appears in various qualities. Brecciated cherts, common in Rajasthan, are cherts that have decayed somewhat due to exposure to metamorphic pressures. As a result, they tend to have low luster and low diaphaneity, and they do not knap as cleanly as plain chert. In Southeastern Rajasthan, chert also appears in a conglomerate form. Here, chert pebbles and rocks combine with quartz and

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other minerals and under intense pressure form a new rock that also has a conchoidal fracture. Because of the many inclusions, it fractures irregularly. Chert conglomerate is not an ideal material for blade manufacture, but it certainly can work if higher qualities are selected. High quality chert conglomerate and low quality quartz are both equally difficult to knap, but can certainly be used to form a wide range of tools, although there will be considerably more debitage and misdirected blows than when using finer materials.

Cherts usually occur in cobble form in limestone formations or in beds. Archaeologists have long used visual analysis to identify chert sources using the qualities mentioned above—color, luster, translucence, and inclusions. However, several conditions must be met before visual analysis is reliable. Each of the identified lithic sources must be comprised of distinct chert varieties. That is, if several sources in a given area have the same color chert with similar luster, diaphaneity and inclusions, then visual analysis has a lower reliability (Luedtke 1992). Similarly, when a chert source contains cherts of more than one color or type, the efficacy of visual analysis is limited. Heat treating can change the color and luster of chert, making it difficult to match to a particular source. Finally, when sources are located near rivers that transport chert cobbles and pebbles for long distances, then sourcing becomes somewhat of a moot point. Finally, non-visual methods of chert sourcing works best in regions where all potential sources have previously been identified, and where sources are concentrated into discrete areas (Glascock 2002; Glascock and Neff 2003).

Chalcedony ranges in color from clear to milky and smoky brown and can occur with inclusions or bands (thus commonly known as agate). Like chert, chalcedony is far

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superior to common quartz for knapping when the goal is a formal tool. It fractures in very predictable ways and can be heat treated for greater control. Heat treating tends to turn chalcedony orange or red, at which point it is known as carnelian (although natural carnelian also occurs in South Asia). While chalcedony has long been popular as a tool material, it is also popular in the form of carnelian as a material for stone beads. The Harappans in particular are well known for their extensive production and use of carnelian beads in multiple shapes and sizes (Kenoyer 1991; Possehl 1982; Roux and Pelegrin 1988-9).

Chalcedony forms naturally in the basalt of the Deccan trap, a geological formation that spans the center of the Indian subcontinent. The northernmost extant of the basalt can be found on both sides of the border between Rajasthan and Madhya Pradesh. Khanna (1992; 1993) had previously hypothesized that the Bagor chalcedony may have been obtained from the northeastern-most reaches of the Deccan trap which extend into this region. Several chalcedony boulders were identified at the site of Semara during field survey. Dense deposits of chalcedony in Gujarat were quarried in the first few millennium BC for the carnelian bead trade and continue to be heavily used by contemporary beadmakers in Cambay (Kenoyer 1991; Possehl 1982; Roux and Pelegrin 1988-9). As noted above, most older site reports from South Asia do not quantify the amount of each raw material recovered during excavations. However, chalcedony is heavily used at Deccan sites such as Inamgaon and sites of the Southern Neolithic such as Tekkalakota since small chalcedony nodules occur naturally in the rivers near to each site (Ansari 1988; Nagaraja Rao and Malhotra 1969).

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Sourcing chalcedony through visual analysis has proved to be more difficult than sourcing chert. This is due to its visual properties: there are fewer colors of chalcedony and a smaller range of translucence and luster since all chalcedony tends to be somewhat lustrous and diaphanous. The careful examination of macroinclusions, when present, has been useful in attempts at source identification.

In sum, all three materials found in southeast Rajasthan—quartz, chert, and chalcedony—are useful for making stone tools including blades and blade tools. Quartz is the least desirable of the three materials because it fractures in uneven and unpredictable ways. Chert and chalcedony are much easier to manipulate, especially when manufacturing very small items. Chert and chalcedony also respond well to heat treatment which means that it is possible to change the way they respond to striking. At this point quartz sourcing is virtually unknown. In addition, it has proven to be possible yet difficult to source chert and chalcedony using standard visual analysis.

Core Production

In most cases, the core is the waste product that was discarded after the production of useful flakes and blades and as such bears scars that tell the story of its use. It is important to remember that the current core shape mostly reflects the final shape of the core before discard. That is, as with scrapers (Dibble 1995), bifaces (McPherron 1994, 1999, 2003), and geometric tools (Neeley and Barton 1994), cores undergo several morphological changes as they are worked. The more intensely a core is utilized, the more shape changes it undergoes. Parry writes that, "Depending on the number of blades that are removed, the number of platforms, and their position on the core, the final core form may be highly variable" (Parry 1994:89). Core taxonomies frequently emphasize

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patterns of reduction (Braucourt 1962; Brézillon 1968; Conard, et al. 2004). Several of the blade cores in this study were clearly turned and worked from multiple platforms; each time a new platform was created, the core shape changed. In addition, the removal of additional blades alters not just the size of the core (i.e. width and thickness), but the shape as well. At times, knappers may change a flake core into a blade core and vice versa. In sum, final core morphology is affected by number of platforms, initiation, technique, raw material, intensity of use, desired blade size, and reason for discard.

Platforms

The number of core platforms distinctly affects the shape of the core. Many blade cores (like cylindrical and pyramidal) only have one platform and all blades are removed in the same direction. Others have multiple platforms and begin to take on a blockier shape. The number of times the core platform was rejuvenated, the number of times and direction the core was shifted during knapping, the number of platforms used, and the direction of removals all leave their mark on the final core. Knapping strategies and errors committed by the knapper also at times necessitate the creation of a new platform, thus shifting the shape of the core again.

Initiation

The first blade removed from a core affects the way that the remaining blades are removed and usually requires some preparation. There are three main ways to initiate blade removals: natural ridge, crested ridge, and burin.

Natural ridges are quite suitable for initiating the first blade. Some raw materials are more likely than others to have multiple ridges conducive to blade production. For

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example, quartz usually occurs in a naturally fractured state with multiple ridges present. It is difficult to make long blades with natural ridges, however. Smith (1974) and Morlan (1970) have noted that natural ridges were used to initiate wedge cores when the raw material, particularly quartz, was conducive to such action.

Crested ridges create an artificial ridge to guide the first blade removal. They are most commonly used when the raw material has no natural angles to guide the first blade, or when a long blade is desired. When the raw material has only rounded edges due to river-rolling or natural formation processes, an artificial ridge must first be created before blades can be removed. Crested ridges are not required when creating short blades (Crabtree 1968), however, they are necessary for thin initial blades longer than 7-8 cm. In the absence of rounded nodules or a desire to create long blades, crested ridges are not necessary for blade production.

Finally, the initial blades can also be removed through a burin-blow (Barton, et al. 1996; Chazan 2001; Crabtree 1968). Coinman and Clausen noted that in many Upper Paleolithic assemblages in the Near East, "various investigators have recognized the core-like features of thick, carinated, polyhedral 'burins,' but they have classified them differently, resulting in inconsistent classifications and interpretations" (2000). However, pilot research on the assemblages from Gilund and Bagor indicated that this type of initiation had been frequently used. For burination to be possible a natural ridge or edge from previous flaking must be available. Large, fat flakes with fresh edges can be easily burinated and converted into a bladelet core. It can be difficult to find this in the archaeological record because traces of the initial blade are removed when the core is used intensively. Although the presence of multiple burin spalls should point to the use

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of this technique, it should be noted that it is not possible to distinguish between a burin spall and an initial blade made with a burin blow (Barton, et al. 1996). Denali burins found in Alaska, which resemble cores from both the Campus site in Alaska and Shirataki in Japan, also have many attributes in common with burins (Hadleigh-West 1967). Parry suggests that burinated initiation is similar to Kobayashi's "System B" (Kobayashi 1970), and that it is used in North American microblade production in Alaska and the Northwest, the Channel islands, Mesoamerica, and Cahokia. He writes that the differences between burinated initiation and other initiations "may have a significant relationship both to the organization of production, and to the intended uses of the tools. It is possible that important variability is obscured by lumping these two distinct technologies together" (Parry 1994:89).

Jeanne Arnold points out that, "a knapper experienced with siliceous materials is aware that different kinds of blade ridge preparation result in different kinds of blades" (Arnold 1987:217). Arnold found sites in close proximity in the Channel islands which had different distributions of the use of the crested ridge. She argues that it is "more rapid but wasteful" to create the initial blade without the crested ridge (Arnold 1987: 228). At the site with plentiful crested ridges, she found fewer failures among the lithic products. She explains the difference as one of expedient versus formal technologies which are selected due to proximity of raw material.

Raw Material

Raw material also influences core shape and knapping strategy through quality (grain size and presence or absence of flaws), initial size and shape, and proximity of source (Owen 1988). As discussed above, quality of raw material is one of the biggest

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factors in knapping strategy and fracture patterns. When producing blades with high-quality material, like chert and chalcedony, it is easier to control the shape of the core and to make a symmetrically shaped core such as cylinders and pyramids. This is much more difficult with low quality material, like quartz, which lends itself to blocky or amorphous working.

The initial size and shape of the raw material also influences the core shape and the knapping strategies pursued by the knapper. Cherts and chalcedonies gathered as small river cobbles have limited affordances due to size and their rounded shape. That is, small cores will never produce large blades and must be worked in fairly limited ways to produce the longest possible blades within the constraints of the original parameters. It is thought that naviform technology of the Levant is in some respects a response to flat ovular chert nodules, although the technology varies substantially between areas due to the nature of the available raw material (Quintero and Wilke 1995:20).

Finally, proximity of raw material source and quantity available strongly affects the ways that cores are prepared. As discussed above, when raw material is not in close proximity knappers may use their existing cores more efficiently or more intensely. Intensity of use is related to raw material quality and availability, as well as scheduled tool production.

Intensity of Use

Intensity of use, or curation (Shott 1996), is admittedly difficult to enumerate. However, when examining cores, it quickly becomes apparent that some cores have more blade removals than others. While some cores were discarded after one or two blade removals, others were not discarded until they were too small to remove another blade.

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Repeated blade removals can change the shape of a core. For example, Morlan in his description of Japanese cores writes,

> "I have yet to establish a suitable boundary definition for separating wedge-shaped cores and conical or cylindrical cores. In the New World Arctic I have encountered a similar problem with respect to tabular cores. A specimen which begins as a thick wedge-shaped core with a flat wedge element will, through successive microblade removal, undergo foreshortening of the platform element until the long axis of the platform shifts from the plane of the face elements to that of the fluting chord. If the distinction between facially and marginally distributed flutes is strictly followed a given specimen may, through use, change from wedge-shaped to tabular...I have yet to devise an adequate boundary definition for wedge-shaped and tabular cores" (Morlan 1970:19).

Technique

Core shape is obviously most influenced by knapping technique. Technique here is comprised of multiple components including knapping force (i.e., hammer, punch, or pressure), direction and order of blade removals, and holding position or use of a vise. Each of these factors can influence the final core.

It is nearly impossible to fabricate a small cylinder core, for example, without the use of pressure debitage. How the core is worked after initiation also ultimately influences the end shape of the core. Working the core in a circular fashion leads to a cylinder or pyramid while working the core backward like slicing a loaf of bread leaves a core that appears wedge-shaped, block, or amorphous.

Another aspect of technique is the device used to hold the core during blade manufacture. Many blades produced by pressure debitage are made when the core is held in some sort of vise (Crabtree 1968). This is also true for wedge cores (Tabarev 1997). The vise may have been wood, bone, or antler with straps of leather or some other material that held the core in place during manufacture. Alternatively, small blade cores

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can be worked while held in the hand (Gryba 2006). It is thought that a vise was used in multiple regions of South Asia in the third millennium BC (Inizan and Lechevallier 1990). Blade knapping devices probably varied greatly between regions, and even within them. The size and shape of the vise limits the size and shape of the core since the raw material has to fit into the vise and remain there until knapping is complete. Material that is too big or too small may be difficult to work, although these limits may vary according to the vise used. The vise also influences the number of removals that may be accomplished before the core needs to be turned, shifted, or adjusted. A vise that allows for constant turning can more easily produce a cylindrical or pyramidal core than a more restrictive vise that impedes easy turning between each blade removal. A vise that requires much re-adjusting and tightening after each turning will not easily facilitate the creation of a cylinder or pyramid core, but would lend itself to the production of wedge, block, and half-cylinder cores.

Desired End Product

Desired blade size also influences core shape. Blade length is not arbitrary, but can be controlled by knappers by varying the length and width of the core. In fact, at many sites, blade lengths tend to be quite regular. Since blades are manufactured to fit into hafts that last much longer than the life of the blade (or microlithic tools), knappers need to produce blades that are relatively standard in length and width. Long thin blades are difficult to manufacture on cores that are any shape other than cylinder or pyramid. Short blades, on the other hand, are much easier to make in quantity on a wedge-shaped core. Core shape, then, can be seen as a residue of efforts by the knapper to standardize blade size.

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Reason for Discard

Since archaeologically retrieved cores represent the final form of the core before discard, it possible to estimate the reason for discard. While it is not possible to know the specific conditions under which each individual core was discarded, it is helpful to examine each core for signs of flaws. Flaws such as multiple hinge fractures and extreme overshots that split the core can render a core beyond rejuvenation. Sometimes existing raw material flaws like geodes or cracks prevent the removal of the next blade or flake. At times, cores appear to be flawless, but are so small that it would be difficult to remove any further blades. Each of these flaws influence the knapper's decision to discard the core and also affects core morphology.

Shape

Similar end products can be created by a multiplicity of core types (Dibble and McPherron 2006). Blades and microblades can be created through a variety of techniques from cores of many different shapes. Indeed, the archaeological record demonstrates great variety in the shape of blade cores.

Descriptions of blade core shapes are not standardized between regions, nor, in many cases are they standardized within regions. Patterson presents a useful typology that includes five categories: face faceted, edge-faceted, symmetrical, cuboid, and amorphous (Patterson 1975:122). Face-faceted blade cores are cores where all blades are removed exclusively on the widest side of the core. These include tabular, semi-conical, and semi-cylindrical cores. Edge-faceted cores have blade removals exclusively on the narrowest side of the core. These include wedge-shaped cores. Symmetrical cores have a single striking platform and are worked on all sides; the core is most likely continually

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rotated during working. These include conical, cylindrical, and truncated pyramid cores. Cuboid cores are cuboid in shape and may have a single or multiple platforms. Finally, amorphous cores are worked at random.

While symmetrical cores such as cylindrical and conical shapes are common throughout the Near East, wedge-shaped or keel-shaped cores are more common in Asia and the Northwest coast of North America. Wedge-shaped cores are thought to have originated over 25,000 years ago (Tabarev 1997). There are various types of wedge cores, but generally they are produced by creating a biface that serves as a pre-form. Then, one side is removed with a single blow to create a flat surface. The removed flake is called a ski-spall. Next, one or both ends of the biface are removed to create additional flat surfaces. Any of the flat surfaces may then be used as a platform for blade removal. An alternative manufacturing sequence creates the platform before a series of bifacial flakes are removed from the body.

There are multiple techniques that create the wedge shape; for this reason, Hayashi argues that "the term 'wedge-shaped core' covers too much variation…should be re-examined and should be used in a more restricted sense" (Hayashi 1968). Identified techniques that make wedge cores include the Fukui technique (Hayashi 1968:164), the Yubetsu technique (Kobayashi 1970), the Campus Technique (Morlan 1970), the Denbigh Technique (Morlan 1970), and the Fulton Technique (Sanger 1970). There are also multiple subtraditions within these techniques, each of which is defined by the order of flake or blade removal. Naviform cores, similarly shaped cores made with hard percussion and a dramatically different core preparation and blade removal

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technique briefly appeared then disappeared in the Pre-Pottery Neolithic Levant (Quintero and Wilke 1995).

Wedge-shaped cores come in multiple forms. Hayashi argued for semi-conical, atypical boat, and typical boat shapes (Hayashi 1968). Unlike cylindrical cores, which are initiated with a crested ridge and then rotated continuously during blade removal, wedge cores are only worked from one angle, and blades are removed like slices of bread from a loaf. While cylindrical cores are worked all-around from a single platform, wedge cores are worked in one direction, and then a second platform may be utilized if the angle is no longer productive. Thus, cylindrical cores have one platform, while wedge cores may have multiple platforms.

As mentioned above, cores change shape as they are being worked. A cylindrical core may become conical, or a wedge-shaped core may become more cuboid in shape as the work progresses. However, there are limits to these changes. A cylindrical core worked all the way around will never appear wedge shaped, nor will a wedge-shaped core appear to be cylindrical. The technology employed leaves discernable marks, with some variation.

Studying core shape is only useful insofar as it suggests the core preparation and blade removal techniques employed. In his study of Japanese wedge-cores, Hayashi writes, "typology based on the pattern of manufacture of the implements should be distinguished strictly from typology based on morphological observation" (Hayashi 1968:19). It is the core and blade production techniques that are of interest here.

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Lithics and Technology

Lithics have received the lion's share of archaeological attention as the material representation of past technological processes and practices. Linking lithic artifacts to actions, behaviors, and interactions in the past has presented a number of challenges and archaeologists have developed a series of theoretical frameworks to guide this process. Anthropologists and archaeologists have long understood that technology is embedded in a broader cultural context and is historically contingent (Dobres 2000; Lemonnier 1992, 1993a; Pfaffenberger 1988, 1992; Schiffer 2001). Two sets of related theoretical frameworks are presented here in order to situate the main focus of this research project. First, approaches to studying the life of an artifact are presented to situate lithic assemblage variability. Second, a discussion of skill acquisition and technological knowledge is presented to highlight the relevance of the study of core production.

Biography of Lithics

The tracing of life histories of artifacts is one way that archaeologists began to understand lithic assemblages. In broader studies of material culture, the biography of things has been a highly instrumental way of understanding technology and the role of the practitioner, producer, and consumer (Appadurai 1986; Kopytoff 1986; Walker and Schiffer 2006). All of these aspects together are seen to influence technological strategies and the production of material culture. In lithics, life histories have been traced through the concepts of *chaîne opératoire*, organization of technology, and reduction sequences, all of which fall broadly under the category of "sequence models" (Bleed 2001). The overall goal of each of these approaches is to reconstruct how artifacts were made. However, while related, each of these approaches emphasizes different aspects of

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artifact production and use. In many ways, these analytical frameworks have much in common with anthropological considerations of material culture that consider the life of an artifact.

Chaîne opératoire examines the life of the artifact from raw material procurement through production, exchange, and use. Here, the focus is on the producer and his or her techniques, gestures, intentions, and choices. The prevailing viewpoint is that, "any technique, in any society, though, be it a mere gesture or a simple artifact, is always the physical rendering of mental schemas learned through tradition and concerned with how things work, are to be made, and to be used" (Lemonnier 1993a:3). *Chaîne opératoire* argues that at any stage in the process of production, the individual artisan is faced with multiple choices. *Chaîne opératoire* is seen as variable between producers and focuses mainly on the mental aspects of production. However, as Schiffer and Skibo (1997) point out, choosing between techniques can limit choices further down the production chain, and also has an affect on performance characteristics of the artifact. By creating a correlate matrix, it is possible to compare the benefits of selecting certain techniques against material constraints of each technique (Schiffer and Skibo 1997). Similarly, a performance matrix compares an artifact's performance characteristics in relation to the people and groups who are part of the artifact's life history (Walker and Schiffer 2006).

First proposed by Leroi-Gourhan (1964), *chaîne opératoire* was used in multiple studies on pottery because potters are typically seen as artisans who apply their artistic vision to the creation of pots (see, for example Gosselain 1998; Mahias 1993; Roux and Corbetta 1989; van der Leeuw 1993). However, it works most effectively on lithics because each stage of production is fossilized in the debitage that remains. Unlike

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pottery, which is an additive process and leaves minimal traces of production, lithic production is a reductive process and all flakes or blades removed can potentially be identified, as well as the order in which they were removed (Sellet 1993). Lithic refitting studies exemplify the potential of *chaîne opératoire*. Roux's study of the manufacture of carnelian beads in Gujarat, India, employs the concept of *chaîne opératoire* in order to understand how artisans planned and implemented their work (Roux 2000; Roux and Pelegrin 1988-9). The use of *chaîne opératoire* as a vehicle for understanding lithic production and ancient technology has been most popular among French researchers, although it is by no means limited to them.

The organization of technology also focuses on the life of the artifact from raw material acquisition through production, use, and discard (Andrefsky 1994; Carr 1994; Johnson and Morrow 1987; Nelson 1991). The emphasis is less on the individual producer than on the social and environmental context within which artifacts are produced, as well as the physical properties of the materials being worked. Studies focus on the mobility or subsistence strategies of groups, the climate within which they lived, the proximity of raw material sources, and the various properties of stone. The ultimate use of the artifact is also considered. Finally, discard is also examined.

The study of lithic reduction sequences is very similar to the study of the organization of technology. Exemplified by studies of scraper reduction (Dibble 1995), or biface production (McPherron 1994, 1999, 2003), they focus more tightly on the material properties of the artifact. Both individual intention and social context are downplayed so that the most basic assumptions about artifact typology and production can be evaluated and challenged.

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This research project employs aspects of each of these approaches in order to identify the similarities and differences in the lithic assemblages of two very different sites. Typology and attribute analysis are shaped by concepts of reduction sequences; most geometric tools are viewed as interchangeable because through simple reduction they can easily morph into each other (Neeley and Barton 1994). More importantly, however, the production of cores is seen as a single point in the life of the artifact that represents its state of reduction at the point of discard. While multiple core types were evident at both sites, it is clear that further reduction could have caused any one of the cores to change shape and to acquire distinct attributes. These factors remained constant at both Gilund and Bagor. While they must be considered in order to fully understand how the assemblage at either site was created, they cannot offer insight into the potential differences between the two sites.

In many ways, the difference between these approaches—organization of technology, *chaîne opératoire*, and reduction sequences—is a question of scale. Organization of technology examines the level of society, *chaîne opératoire* examines the level of the individual, and reduction sequences examines the artifacts themselves. Together, these approaches examine the individual in society and the material culture that is part of that culture.

Social Context

The techniques that comprise lithic production are, like the techniques of other technologies, "social productions" (Lemonnier 1993a:39). As such, they are "simultaneously embedded in and partly a result of non-technical considerations" (Lemonnier 1993a:3). Technology should not be separated from social organization or

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ideology (Schiffer 1992:131). Material, technological, and social aspects combine in "constellations of production" (Sinclair 2000:4) and influence the final morphological form of the lithics produced.

Both the production and use of lithics is highly variable between different communities, in part because of differing cultural contexts. While lithics can be used to fulfill needs for tools or to accomplish tasks, those needs are themselves culturally constructed (Wilk 2001) and can be met with multiple solutions (Lemonnier 1992). In the case of mobility, for example, Odell writes that, "the association of mobility with different technological strategies suggests that more than one solution was possible and that the choice depended as much on historic trajectory as on ultimate efficiency" (Odell 2001:63). Early efforts to understand how lithics are culturally embedded and fulfill needs were evidenced in the Binford-Bordes debates on style and function (Binford 1973; Binford and Binford 1966; Bordes 1961). Today, lithic analysts have moved beyond those debates and acknowledge that style and function both influence lithic assemblages, but so do many other factors.

In many ways, the concept of technological style addresses the gap between style and function while incorporating a notion of production within specific cultural contexts (Lechtman 1977). According to Lechtman,

> Artifacts are the products of appropriate cultural performance, and technological activities constitute one mode of such performance. What I have called the style of technological behavior is the rendering of appropriate technological performance…Technologies are performances; they are communicative systems, and their styles are the symbols through which communication occurs. The relationships among the formal elements of the technology establish its style, which in turn becomes the basis of a message on a larger scale (Lechtman 1977:12-13).

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In isochrestic style as put forward by Sackett (1982; 1986), the style comes not from decoration, but from the technology used, which is shaped by cultural norms and traditions, which are passed on through learning. Weissner picked up Sackett's considerations and applied them in an ethnographic context where she found that style has a communicative aspect (Weissner 1984), a finding similar to that of Wobst (1977). She writes that, "people compare their ways of making and/or decorating artifacts with those of others and decide to imitate, differentiate, ignore, or in some way comment on how aspects of the maker or bearer relate to their own personal and social identities" (Weissner 1984:194). While lithic products may have technological and isochrestic style, lithic production can also be seen as a performance and communication because lithics are frequently produced in public spaces, and specific techniques employed may also be observed. Barth argues that "people sustain their identity through public behavior" (Barth 1969:132). This includes public demonstrations of stone knapping. In public performance, the right and wrong way to position the raw material or knapping tool, along with body position, and attention to any ritual details are all observed and open to commentary. However, adhering to technological style does not necessarily preclude innovation (Wright 1993).

Lithics are also made according to the technological traditions of communities. These traditions suggest the proper way that tools should be made. Dobres writes that, "technologies materialize taken-for-granted (and often tacit) cultural ontologies for understanding and making sense of the world, in a very real sense they also express and reaffirm social values about the right and wrong ways things should or should not be done, and by whom" (Dobres 2000:104).

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Like many other archaeologists, Dobres sees technology as a social practice as defined by Bourdieu (1977). As practice, technology incorporates more than just artifacts, and is considered to be "meaningful acts of social engagement with the material world" that facilitates social relations (Dobres 1995:96). This is also extended to the concept of *habitus* in the context of production (Dietler and Herbich 1998; Dobres 2000, 2001). Similarly, many draw from Giddens (1984) and see technology as recursive in that it both shapes and is shaped by the broader cultural context (Dobres 2000). Here, technology is seen as agentive action.

Technological traditions can follow social boundaries (Hegmon 1998; Lemonnier 1986; Stark 1998), although these boundaries may be difficult to define archaeologically (Hegmon 1998). Technological traditions can bridge communities as well. Members of communities that are unrelated to village or macrogroup boundaries may share techniques and technological traditions with other community members spread throughout the region and beyond. For example, technology does not necessarily coincide with ethnic boundaries (MacEachern 1998). Neighbors who live in close proximity may follow different technological paths. However, when craft production is standardized at the village or macrogroup level and varies between villages or macrogroups, interaction can increase the number of techniques shared in common. At the same time, the use of distinctive techniques at the level of the village may allow communities to express their identity and to engage in place making in order to offset increased regional homogenization of artifacts (Bartlett and McAnany 2000). Alternatively, common technologies, and technological knowledge, may be shared across a region even when styles vary greatly (Wright 1989).

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Skill Acquisition and Technological Knowledge

This project also investigates the role of the individual in the production of lithics through the concept of skill acquisition. Technology and technological traditions are transmitted between generations when they are taught, learned, shared, and imitated. Mauss considered techniques to be any bodily movement such as running and swimming, as well as those movements that are performed in concert with objects, like digging (Mauss 2006 [1936]). According to him, the body is "man's first and most natural technical object" (Mauss 2006 [1936]:83). He considers "technique" to be "action which is *effective* and *traditional*…there is no technique and no transmission in the absence of tradition" (Mauss 2006 [1936]:82 italics in the original). Sackett (1986) argued that tradition and learning are tightly linked together. Stout suggested that, "no task exists apart from the physical and social matrix that gives it structure and meaning. In order to appreciate the mental dimensions of stone knapping or any other skill, this fact must be taken into account" (Stout 2002:695).

Inizan and Lechevallier argue that blade core production, "needs to be learned by a long practice and the perfection observed in the archaeological assemblages is obviously the fruit of specialized apprenticeship" (Inizan and Lechevallier 1990:44). Microlithic technology is a fairly difficult skill that must be taught in order to be transmitted to the next generation. Blades and tools are made in very particular ways that must be learned and practiced. The production of long blades, in particular, require great skill (Pelegrin 1990).

The concept of what makes a proper tool must be learned and may vary between communities. As a result, similarities in tools and production processes indicate that skill

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and knowledge may be shared between communities. Moreover, it is possible that both communities share a template for the proper way to make a blade, tool, or core (Bartlett and McAnany 2000; Keith 2005; Roux 2000; Stout 2002). Those who affiliate with distinct groups may have separate conceptions about technology and tools, how to make them, and what they should look like (Weissner 1984). This is not to say that lithic style should be equated with culture groups; however, lithic production is a skill that must be leaned and taught, and conducted within the bounds of social norms. As such, it is influenced by cultural affiliation, just as it is influenced by mobility, subsistence, activity, and raw material access. Johnson argues that where similar core technologies are present, "if the sites where the cores were found happened to be only 100 miles apart and the cores were used contemporaneously, it would be difficult to argue for the independent invention of the core technology" (Johnson 1986:23-24). That is, the technical knowledge is shared.

Blade core technologies are comprised of specific techniques that must be performed in the proper sequence. They are learned technologies that require some skill (Roux 2000; Roux and Corbetta 1989). In many ways, lithic production is a traditional practice and an acquired skill. Basic knapping including blade removals can be learned quickly, but core preparation takes more training and practice. That is, there is more than one way to make a lithic blade or blade core, and each one must be learned. When the inhabitants of sites use similar core technologies, it indicates that they have a common skill set that was obtained by shared knowledge (Wright 1989). It also means that they have a shared sense of the proper way to manufacture items (Weissner 1984). Dobres writes that technical "knowledge (and its display through skill and competence) can be a

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means for earning, or better yet making, a place for oneself in the community…through the way technical know how and know to establishes one's reputation; or, through proscribed relationships between the skilled and unskilled and between those who know how and those who do not" (Dobres 2000:87). More importantly, similar lithic production techniques indicate shared histories between communities.

Conclusion

This chapter has reviewed multiple approaches to lithic analysis in order to contextualize the methods undertaken in this research project. Various aspects of the organization of technology were reviewed with a view towards questions of mobility and sedentism. Second, raw material properties and procurement patterns, which are of central importance to understanding lithic assemblage variability, were discussed. Special attention was devoted to core production methods. Finally, broader links between lithics and technology were discussed along with the place of technology in culture. In short, lithics are seen here as a form of technology, which in turn is seen as a form of cultural practice. Skill transmission and acquisition is one way that cultural practices are passed down between generations.

Mobile and settled people frequently have different raw material procurement strategies, which can influence assemblages (Binford 1979). Mobile and sedentary people sometimes engage in distinct subsistence practices or activity patterns, which also affects lithic assemblages. While the effect of degree of mobility on assemblages is an important question, multiple other factors must be considered (Bamforth 1991) including raw material (Andrefsky 1994) and contemporaneity (Stafford 1999).

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Raw material quality, proximity, and quantity all affect lithic assemblages as well. Quartz is usually of poor quality and can be difficult to control while knapping. It is also difficult for archaeologists to source chert. Chert and chalcedony fracture in much more predictable ways and are a much better material for making blades and microlithic tools.

Cores are highly variable since they are frequently reworked. However, cores leave signatures of the way that lithic production was undertaken. The type of initiation, number of platforms, blade removal techniques, desired blade size, raw material, reason for discard, and intensity of use all affect the final core shape. Three types of initiation are commonly found for blade cores: crested ridge, natural ridge, and burin. Understanding core production can provide insight into similarities and differences between technological strategies, practices, and skills at the sites of study.

While it is certainly possible to view lithics as an artifact class without considering the broader category of technology, it is best to link lithics to broader cultural questions. Anthropologists and archaeologists have long pondered the relationship between technology and culture and have devised many theoretical pathways to approach understanding. Considering the full life of the artifact clearly allows for a full understanding of the multiple procurement, production, use and discard processes through which a lithic (or any artifact) travels. Considerations of technology have been closely linked to the debate over style and function of artifacts that engrossed archaeologists for many decades. More recently, it has been common to view technology as a form of practice that is shared between members of a community and is passed to the next generation through various passive and active skill transmission activities.

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When considering the lithics of Gilund and Bagor, it is important to understand where each community gathered the raw material, and under what contexts tools were produced and used. Because these two sites are very different, it is not unexpected that their lithic assemblages will vary. Levels of mobility, subsistence strategies, craft production and other activities, and other daily practices all shape the production of lithics and the way that they were deposited in the archaeological record. Finally, shared core production techniques between Gilund and Bagor indicate interaction between these two communities, as well as a shared history of skill transmission.

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Chapter 5. Lithics in South Asia

Introduction

This dissertation compares the lithic collections from Gilund and Bagor in an effort to understand how technological practices and strategies of two very different communities intersect and diverge. In the previous chapter multiple factors that influence lithic technology were considered including mobility, subsistence, craft production, and skill acquisition. All stages in the life of lithic artifacts were considered from raw material procurement through final discard, with an emphasis on raw material acquisition and core production strategies. While the previous chapter considered lithic analysis using case studies from around the world, this chapter focuses on lithic studies conducted in South Asia. Allchin and Allchin were the first to note that stone tools are the best artifact available for comparison between camps and villages since pottery is fragmentary at microlithic scatters and there is a paucity of artifacts at substantial settlements that can be safely attributed as imports from hunter-gatherers (Allchin and Allchin 1974: 50). In order to properly situate the lithic production techniques used at Gilund and Bagor, temporal and spatial variation in lithic production techniques across South Asia from the early Holocene onward are surveyed here.

Researchers have recorded vast chronological and regional variation in South Asian lithic assemblages. However, for the most part, these comparisons have been made in broad strokes. That is, Upper Paleolithic and Mesolithic assemblages have been compared, as have Mesolithic and Chalcolithic assemblages, although finer chronologies within these timeframes have not been examined. Regional differences have received

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less attention, but can be pieced together by examining multiple site reports. In addition, a few synthetic articles take a broad view of regional and chronological variation (Allchin 1973, 1985; Cleland 1986; Datta 1991; Inizan and Lechevallier 1990; Jayaswal 2002; Kenoyer 1984; Misra 2002a; Ray 1985; Sankalia 1964b; Selvakumar 2002; Varma 2002). This chapter does not seek to define and delineate regionally-bounded cultures based on lithic assemblages; however, chronological and regional variability is presented as the backdrop or context within which lithic assemblages are created. In sum, variation in lithic assemblages is created by the intersection of chronology, region, and the behavioral and cultural factors discussed in Chapter 4: mobility, subsistence, daily practices, raw material, skill transmission, and discard behaviors.

Mesolithic in South Asia

The South Asian Mesolithic is a subject of much debate and is of interest here because the initial occupations at Bagor fall into this time period. Several attempts have been made to characterize Mesolithic assemblages in South Asia as distinct from Upper Paleolithic and Chalcolithic assemblages. It appears that there is no single industry or technology for the entire subcontinent during each period; instead regional variability existed within each of these periods, further complicating the efforts of archaeologists to untangle the industries and grasp the character of each—a problem also faced by archaeologists who study the Mesolithic to Neolithic transition in Europe (Stafford 1999).

This project is complicated by the difficulties archaeologists have had in identifying sites or layers within sites as Mesolithic. The tendency to label all microlithic scatters encountered through survey as "Mesolithic" adds to this problem. There is

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actually wide variation in the chronological and archaeological contexts in which microliths have been documented.

Foote, the first archaeologist to attempt a chronology of lithic industries in India only discusses the Paleolithic and Neolithic time periods (Foote 1916). He does not use the term "Mesolithic," nor does he discuss lithics for sites designated Chalcolithic or later. Since the terms "Paleolithic" and "Mesolithic" originated in European contexts, Allchin argues that they do not properly fit the Indian situation (Allchin 1963). In order to remedy this problem, she proposed using the African sequence of "Early Stone Age," "Middle Stone Age," and "Late Stone Age" or LSA. Here, the LSA refers to a period that encapsulates both the Upper Paleolithic and Mesolithic phases because the lithic technology is seen to have many similar features. This framework was accepted by International Congress of Asian Archaeology in 1961 (Allchin 1963: 214). Although used for some time, this nomenclature was later discarded in favor of the European sequences. As a result, "Mesolithic" remains firmly embedded in the classification system of South Asian sequences.

According to Misra, "Mesolithic is a brief period, whose duration varies from a few centuries in the Near East to some thirty-five millennia in Sri Lanka…The technological hallmark of this period is tiny stone tools or 'microliths'" (Misra 2002b:2). In his definition, it was the people of the Mesolithic who were "pioneering farmers" that initiated domestication of plants and animals (Misra 2002b:3).

Ajithprasad argues that "Mesolithic" refers to:

> …a post-Pleistocene cultural assemblage which immediately succeeds the Palaeolithic period. It is marked by the predominance of microlithic artifacts comprising small geometric and non-geometric tools indicating by and large a hunting and gathering economy. In addition to this, the

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> assemblage almost invariably incorporates pieces of flat, palette-like pieces of sandstone and very rarely ring-stones or mace-heads. Rarely, do we come across pottery; however, in general, Mesolithic assemblage is devoid of pottery (Ajithprasad 2002a:156).

His argument is an attempt to provide speficity to the concept of the Mesolithic, which had been too widely applied to be useful. Morrison provides a similar definition. She states that the Mesolithic refers to:

> a time period that begins with the Holocene, about 10,000 years ago. The end of the Mesolithic is difficult to fix; conventionally the term is used loosely to refer both to a hunting and gathering way of life and to a time period. As an archaeological phase designation, it often includes all time periods after the start of the Holocene and prior to the development of agriculture, i.e. the Neolithic (thus, as late as c. 2500 BC in South India, and as early as the seventh millennium BC in the northwest)...Of course, the use of the term Mesolithic to describe contemporary people is also not unknown, so in some (not very useful) sense one might imagine that the Mesolithic period has not yet ended (Morrison 2002c:27).

As Kennedy has pointed out, sites are "sometimes designated as Mesolithic, but that are actually contemporaneous with Neolithic, Chalcolithic, or Iron Age sites" (Kennedy 2000:192). He adds that, "Although the term Mesolithic maintains its value as a category of lithic industries predominant in early and middle Holocene times, it does not define a specific post-Pleistocene culture beyond the general characters of a hunting-foraging lifeway from which developed incipient agriculture and pastoral practices" (Kennedy 2000:199).

Possehl and Rissman (1992:469) provide one method of categorizing microlithic sites in South Asia by dividing them into three "aspects": the Mesolithic, early food production, and interactive trade and barter. In this framework, Mesolithic, "is properly used to refer to Old World archaeological assemblages that fall within the Holocene and

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lack evidence for food production or an accommodation with surrounding food-producing peoples" (Possehl and Rissman 1992:469).

The conflation of "microlithic" and "Mesolithic" has also been addressed by Hooja in her study of multiple sites in the state of Rajasthan. She challenges the notion that microliths and other hunting tools were no longer used in the Chalcolithic and argues that, "some degree of 'hunter-gatherer' lifestyle continued to be practiced even when a 'more advanced' technological skill had come into use" (Hooja 1988:87). She adds that "the bulk of the Mesolithic is, by definition, pre-Chalcolithic (and, therefore, earlier than the c. 2500 B.C. Aharian)" but that "the continuation of the 'Mesolithic tradition' should not appear improbable or even unique" (Hooja 1988:99).

In this study, "Mesolithic" is a chronological designation that refers to the period after the Upper Paleolithic and prior to the Neolithic or Chalcolithic; that is, the Mesolithic is an early Holocene time period prior to food production. In order to characterize any one site as Mesolithic, it is important to examine absolute dates, as well as material culture. While hunting and gathering and microlith production are features of the Mesolithic, they are also features of other time periods and cannot be used to *define* the Mesolithic, although they can be used to *describe* the Mesolithic. While Mesolithic is sometimes referred to as Holocene hunter-gathering, this leads to confusion since hunting and gathering continues into the present day in South Asia. Most sites that fit this definition and are designated "Mesolithic" are found in the north and central parts of South Asia and begin roughly the ninth millennium BC at Sarai Nahar Rai and Baghor II, for example, or 5500 BC at Bagor (Possehl and Rissman 1992). Table 5.1 presents major excavated Mesolithic sites of South Asia, but should not be considered to be all-inclusive.

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Langhnaj, Sarai Nahar Rai, Mahada, and Oriyo Timbo, and Bhimbetka, although considered by many to be Mesolithic are not considered here to be Mesolithic sites because they were occupied at later dates. In the case of Sarai Nahar Rai, Mahada, and Bhimbetka, additional dating samples were found to be more recent than earlier samples (Kennedy 2000:197-8; Lukacs 2002; Possehl and Rissman 1992).

Because Bagor was occupied for several millennia, it falls into both categories of Mesolithic and Chalcolithic by most definitions. The earliest occupations largely consist of microliths and the faunal remains of wild animals and are largely devoid of ceramics. The inhabitants subsisted through hunting and gathering, and agriculture had not yet been established in the Mewar Plain at that time. Later occupations, however, overlap with early farming communities, such as Gilund. In addition, later levels show several copper artifacts and ceramics as well as evidence of food production in the form of bones of domesticated animals and grinding stones. The later occupations overlap in time with phases of the Ahar-Banas and are considered by many to be Chalcolithic, even though microliths continue to be plentiful.

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Table 5.1 Radiocarbon Dates of Sites in South Asia with "Mesolithic" layers[11]

Site	Calibrated dates	5568 Half-life	Location
Adamgarh Cave, microlithic layer	1σ cal BC 6179 (6042) 5960 2σ cal BC 6361 (6042) 5817	5290 BC	Madhya Pradesh
Bagor, period II	1σ cal BC 2565 (2460) 2297 2σ cal BC 2852 (2460) 2143	1995 BC	Rajasthan
Baghor II	1σ cal BC 7416 (7037) 6622 2σ cal BC 7538 (7037) 6455	6140 BC	Uttar Pradesh
Beli lena Athula	1σ cal BC 6389 (6227) 6172 2σ cal BC 6461 (6227) 6016	5500 BC	Sri Lanka
Bhimbetka	1σ cal BC 32 (cal AD 80) cal AD 223 2σ cal BC 166 (cal AD 80) cal AD 336	20BC	Madhya Pradesh
Bhimbetka	1σ cal BC 4895 (4762, 4738, 4727) 4580 2σ cal BC 4951 (4762, 4738, 4727) 4464	3910 BC	Madhya Pradesh
Bhimbetka	1σ cal BC 32 (cal AD 80) cal AD 223 2σ cal BC 166 (cal AD 80) cal AD 336	20 BC	Madhya Pradesh
Bhimbetka	1σ cal AD 1430 (1488, 1609, 1611) 1660 2σ cal AD 1310 (1488, 1609, 1611) 1954	1580 AD	Madhya Pradesh
Bhimbetka	1σ cal BC 4895 (4762, 4738, 4727) 4580 2σ cal BC 4951 (4762, 4738, 4727) 4464	3910 BC	Madhya Pradesh
Bhimbetka	1σ cal BC 1120 (976, 965, 935) 831 2σ cal BC 1297 (976, 965, 935) 797	870 BC	Madhya Pradesh
Bhimbetka	1σ cal BC 190 (40) cal AD 76 2σ cal BC 373 (40) cal AD 223	100 BC	Madhya Pradesh
Bhimbetka	1σ cal BC 795 (758, 679, 650, 547) 405 2σ cal BC 823 (758, 679, 650, 547) 380	540 BC	Madhya Pradesh
Bhimbetka	1σ cal BC 2026 (1887) 1745 2σ cal BC 2180 (1887) 1633	1610 BC	Madhya Pradesh

[11] Dates were gathered from Gregory Possehl's Gazetteer and Radiocarbon database

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Table 5.1 Radiocarbon Dates of Sites in South Asia with "Mesolithic" layers (continued)

Site	Calibrated dates	5568 Half-life	Location
Bhimbetka	1σ cal BC 909 (807) 766 2σ cal BC 1046 (807) 407	700 BC	Madhya Pradesh
Bhimbetka	1σ cal BC 6556 (6405) 6177 2σ cal BC 7000 (6405) 5976	5620 BC	Madhya Pradesh
Bhimbetka	1σ cal AD 685 (888) 1020 2σ cal AD 617 (888) 1214	790 AD	Madhya Pradesh
Bhimbetka	1σ cal BC 413 (391) 207 2σ cal BC 766 (391) 124	370 BC	Madhya Pradesh
Bhimbetka	1σ cal AD 75 (256, 296, 319) 531 2σ cal BC 157 (cal AD 256, 296, 319) cal AD 654	190 AD	Madhya Pradesh
Bhimbetka	1σ cal AD 893 (997) 1028 2σ cal AD 789 (997) 1165	890 AD	Madhya Pradesh
Bhimbetka	1σ cal AD 997 (1041, 1150) 1222 2σ cal AD 885 (1041, 1150) 1286	1000 AD	Madhya Pradesh
Bhimbetka	1σ cal BC 1120 (911) 803 2σ cal BC 1381 (911) 539	830 BC	Madhya Pradesh
Chopani Mando, period III	1σ cal BC 3491 (3336) 3039 2σ cal BC 3620 (3336) 2913	2590 BC	Uttar Pradesh
Langhnaj	1σ cal BC 2468 (2390, 2389, 2333) 2145 2σ cal BC 2589 (2390, 2389, 2333) 1987	1925 BC	Gujarat
Lekhahia I, Phase II	1σ cal BC 7035 (7001, 6835, 6818) 6706 2σ cal BC 7193 (7001, 6835, 6818) 6606	6050 BC	Uttar Pradesh
Mahadaha	1σ cal BC 2466 (2285) 2045 2σ cal BC 2615 (2285) 1909	1890 BC	Uttar Pradesh
Mahadaha	1σ cal BC 2853 (2553, 2543, 2493) 2347 2σ cal BC 2884 (2553, 2543, 2493) 2145	2060 BC	Uttar Pradesh
Mahadaha	1σ cal BC 1405 (1022) 803 2σ cal BC 1677 (1022) 403	930 BC	Madhya Pradesh
Mahagara, phase IV			Madhya Pradesh
Mahagara, phase IV	1σ cal BC 9049 (9015) 8741 2σ cal BC 9249 (9015) 8529	7790 BC	Madhya Pradesh

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Table 5.1 Radiocarbon Dates of Sites in South Asia with "Mesolithic" layers (continued)

Site	Calibrated dates	5568 Half-life	Location
Mahagara, phase IV	1σ cal BC 11748 (11522) 11320 2σ cal BC 11989 (11522) 11135	9600 BC	Madhya Pradesh
Mahagara, phase IV	1σ cal BC 11135 (10949) 10761 2σ cal BC 11339 (10949) 10560	9030 BC	Madhya Pradesh
Mahagara, phase IV	1σ cal BC 15,016 (14,524) 13,986 2σ cal BC 15,481 (14,524) 13,365	11790 BC	Madhya Pradesh
Mahagara, phase IV	1σ cal BC 9253 (9045) 8965 2σ cal BC 9950 (9045) 8531	7880 BC	Madhya Pradesh
Sanganakallu	1σ cal BC 1880 (1738, 1711, 1708) 1615 2σ cal BC 1975 (1738, 1711, 1708) 1512	1485 BC	Karnataka
Sanganakallu	1σ cal BC 1869 (1683) 1527 2σ cal BC 1937 (1683) 1442	1450 BC	Karnataka
Sanganakallu	1σ cal BC 1882 (1740) 1619 2σ cal BC 2013 (1740) 1513	1490 BC	Karnataka
Sarai Nahar Rai	1σ cal BC 9958 (9515, 9441, 9438, 9416, 9387, 9331, 9312, 9286, 9276) 9059 2σ cal BC 10210 (9515, 9441, 9438, 9416, 9387, 9331, 9312, 9286, 9276) 9044	8100BC	Uttar Pradesh
Sarai Nahar Rai	1σ cal BC 1251 (1004) 848 2σ cal BC 1392 (1004) 501	910 BC	Uttar Pradesh

Mesolithic Assemblages in South Asia

As microliths comprise the main set of artifacts available for study from Mesolithic sites, it is worthwhile to consider the variation that exists within and between these assemblages. Many archaeologists who study the Indian Mesolithic emphasize the

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presence of geometric tools that were manufactured from blade tools through the microburin technique. It is presumed that these tools were hafted into composite tools for various tasks. In order to determine regional variation in the Mesolithic, these archaeologists usually look at the various proportions of the different geometric shapes and even the presence and absence of certain shapes. Blade and microlithic tool technology has been well studied over the years, but less attention has been paid to the non-tool portion of the assemblages, including blade cores.

Allchin et al (1978) note that there are many similarities between Upper Paleolithic and Mesolithic industries in South Asia and point to the production of blades as the unifying factor. They suggest that Upper Paleolithic industries most resemble those from west Asia. They argue that generally speaking, Upper Paleolithic artifacts are larger than Mesolithic, the blades have more pronounced bulbs and are less regular and wider, and the tools tend to be non-geometric (Allchin, et al. 1978:328). They caution, however, that there are exceptions to these trends and that they are largely describing assemblages in Rajasthan and Gujarat. They argue that western Mesolithic lithics resemble Upper Paleolithic lithics in that they emphasize blades and burins. In Sind, the cores are unidirectional and are removed like slices of bread. It should be noted that Upper Paleolithic sites in South Asia span from 24,000 BC to approximately 8,000 BC (Possehl and Rissman 1992).

Sharma (1965) also proposes a progression from non-geometric to geometric tool assemblages. He outlines a four phase progression of technology: non-geometric tools, geometric tools, geometric tools with pottery, and finally diminutive geometric tools with pottery.

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The Southern Neolithic, which is roughly contemporaneous with the Chalcolithic in many parts of South Asia, spans roughly from the third to second millennium BC (Korisettar, et al. 2002). The time period is characterized by cattle pastoralism, the creation of massive ashmounds, the production of ground stone axes, and the utilization of blade technology. Korisettar et al (2002) write, "In general there are similarities in blade tool technology over a vast area of the peninsula between the Narmada River in the north and Tungabhadra in the south, arguing for the need to consider Southern Neolithic tools within the context of a broader technological tradition that also included the Chalcolithic cultures of Maharashtra" (Korisettar, et al. 2002:177). They add that, "In general, it seems clear that elements of the microlithic industry of the Neolithic period continued traditions that were already in place during the ill-defined 'microlithic' phase of peninsular India" (Korisettar, et al. 2002:177).

Chalcolithic Assemblages in South Asia

Assemblage Variation

Just as early Holocene lithics vary from North to South in South Asia, so do assemblages attributed to the Chalcolithic. Like the Mesolithic, this time period is variously delimited because it was originally defined by the use of copper, which was not initially used in all regions at the same time. With the advent of this new technology, many implements formerly made of stone could be manufactured in copper-bronze, which precipitated some shifts in lithic production and use (Cleland 1986). However, copper was sometimes more difficult to acquire and manufacture than stone (Inizan and Lechevallier 1990:43). Access to copper was not uniform across all regions; Indus and

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Ganeshwar-Jodhpura sites were located much closer to significant copper sources than were Deccan sites, for example (Chakrabarti and Lahiri 1996). Even within sites, not everyone had equal access to copper implements, so stone remained a thrifty option for many. Finally, as discussed above, copper is not the best material option for all activities; at times stone is the stronger, sharper, more durable option (Bhan, et al. 2002:231; Kenoyer 1984:128-9). For these reasons, in addition to those discussed in Chapter 4, lithic assemblages demonstrate great variation across South Asia during the Chalcolithic. Interestingly, experimental studies paired with use of a scanning electron microscope have identified the signatures of copper-tipped punches in the production of lithics in the Indus (Anderson-Gerfaud, et al. 1989; Inizan, et al. 1994; Kashyap 2006; Pelegrin 1994).

Bhan et al (2002) note that, "The study of chipped stone or lithic industries of the Harappan phase is still in its infancy, partly because of the emphasis given to other categories of objects made from bronze, semi-precious stone, shell, etc." (Bhan, et al. 2002:231). However, some general observations have been made by archaeologists. These studies mainly discuss size, assemblage variation, and crested ridges.

Sankalia (1982) notes that Chalcolithic lithics tend to be dominated by blades and that Indus blades tend to be long while blades from other regions are "smaller, narrower, and thinner" (Sankalia 1982:33). Assemblages are also said to vary. Sankalia writes, "retouch disappears during the Chalcolithic and full Bronze Age, being infrequent on parallel-sided blades, and surviving on the rare lunates, trapezes and blunted-back and pen-knife blades and tanged specimens...its reappearance in the Chalcolithic is due to the survival of the Mesolithic through the Neolithic or an independent revival of an older feature based on different technique" (Sankalia 1982:43).

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The Allchins argue that farming settlements (Neolithic-Chalcolithic) use blades and backed blades more frequently than tools, while occupants of temporary camps (Late Stone Age sites) used composite tools more frequently than blades (Allchin and Allchin 1974:61-2). However, this variation exists upon a continuum, such that the assemblages of Langhnaj (temporary camp) and Chandoli (early farming settlement) do not vary much.

Crested Ridges

Many archaeologists have pointed out that crested ridges are a feature of Chalcolithic assemblages in South Asia. The first investigation into crested ridges in South Asia was conducted by Subbarao, who encountered a plethora of them at the site of Maheshvar which is located just north of the Narmada River and was occupied from 1000 to 500 BC (Subbarao 1955). In this article he examines the function of the ridge (which he says is to create longer blades) and traces the geographical outlines of this technology. He notes that crested ridges are found in Europe and the Levant and at several Chalcolithic sites in South Asia. He writes that, "the most significant feature is the association of this industry (so far as we know), only with the Chalcolithic cultures beginning with the Indus Valley Civilization" (Subbarao 1955:129). He then outlines what he believes to be the consequences of the adoption of the crested ridge: "the evolution of a technique of mass production invariably leads to a deterioration of the earlier industry, owing to the standardization of tool types…the appearance of this technique at the transitional stages between the Neolithic and Bronze age, as will be shown further, is very significant, as the blade alone of the earlier series of stone tools has a greater utility with the emergence of metal tools. It also accentuates the process of

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abandonment of minute retouch" (Subbarao 1955:133). He suggests, "Hence the adoption of this technique at Mahesvar may be attributed either to the strong industrial tradition which managed to spread, or may be explained as a device to make the longest possible blades out of the bad, small nodules available locally" (Subbarao 1955:132). Pant (1973) examined the fracture mechanics of crested ridges in order to lend support to the importance of the technique for the manufacture of long blades.

Sankalia argues that crested ridges "do not occur in the purely microlithic industry which, ... precedes the Chalcolithic in several parts of India, although fluted cores and parallel-sided flakes are found in this industry" (Sankalia 1967:265). At the site of Hallur in the Tungabhadra Valley crested ridges are not found in the earliest levels that were dated to 1800-1500 BC; they began to appear after 1500 BC (Nagaraja Rao 1971). Paddayya points out that in the Shorapur Doab Late Stone Age sites do not have crested ridges, but Neolithic sites do (Paddayya 1970:44).

The function of the crested ridge is to create a guide for the removal of the first blade on a blade core. Sometimes they are used to rejuvenate a core by redirecting the direction of blade removal. Semi-crested ridges may be residual after the first blade is removed or may be strategically produced to take advantage of an existing ridge. In some contexts crested ridges are less useful than others. For example, when using smaller cores and producing shorter blades, it is less difficult to guide the initial blade than when the core and desired blade are longer. Similarly, crested ridges are a useful technique when the raw material has few initial, natural ridges, as with river-rolled chert and chalcedony.

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The necessity of the crested ridge has been largely assumed, rather than demonstrated for many Mesolithic and Chalcolithic contexts in South Asia. Sankalia's discussion of blades in *Stone Age Tools* argues that crested ridges are required for the creation of all blades, regardless of prior core shape (Sankalia 1982:39-40). Allchin et al. (1978) also state that blade cores *must* be prepared with a crested ridge, which they call a "longitudinal blade core trimming flake." However, when using naturally broken material like quartz, there are usually sufficient natural ridges to guide the initial blade removal, and the production of a crested ridge is superfluous.

Misra's initial examination of the Bagor collection noted that the crested ridge technique had not been used by the inhabitants. He writes, "Technologically, a distinctive feature of the industry is the complete absence of the crested guiding ridge technique which is so ubiquitous a feature of the blade and microlithic industries of the Neolithic and Chalcolithic cultures in the country" (Misra 1973:96). However, Inizan and Lechevallier's subsequent examination of a small portion of the collection reported that crested ridges were plentiful (Inizan and Lechevallier 1995:18). Unfortunately, as their study focused on demonstrating the presence of pressure debitage, they did not expand on this initial observation about crested ridges; they do not indicate how many they found, nor where they were (i.e., on blades, flakes, or cores), nor do they include them in their table of blade types. Sankalia's Ahar site report did not mention any crested ridges, but Subbarao (1955) states that the initial Ahar excavations by the Rajasthan Department of Archaeology did identify crested ridges at Ahar (Subbarao 1955:141).

The regional differentiation of crested ridges has not been thoroughly investigated. Crested ridges are most popular in the Indus and Deccan regions, but less

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so in other regions. For example, crested ridges are largely absent from microlithic sites in Gujarat which are contemporaneous with Harappan sites. Ajithprasad's survey of Gujarati sites confirmed this trend; he writes, "No actual crested ridge blades are found in any one of the collections…the actual method employed by them for the production of such fine blades is difficult to ascertain as no crested ridge blades are found in any of the collections" (Ajithprasad 2002a:169).

At Ganeshwar in Northern Rajasthan, quartz and chert lithics, including geometric microliths, were found in Phase I, which is described as hunting-gathering/pastoral. Regarding the lithics from Ganeshwar, Hooja and Kumar state, "A distinctive feature of the industry is the complete absence of crested guided ridge technique" (1997:329). Even though it appears that core manufacturing took place on site. There are no crested ridges at the post-Harappan site of Dhatva in central India, even though the industry is comprised of blades and microliths (Mehta 1975). Korisettar et al suggests that, "The crested-guiding-ridge technique, which unites much of the peninsular lithic industries, is absent in the Kaveri valley and upper Tungabhadra and lower Bhima regions" (Korisettar, et al. 2002:177).

Crested ridges are common in the Indus. Because many sites are situated in regions that lack sufficient stone, the inhabitants frequently imported cores from places like the Rohri Hills (Biagi and Cremaschi 1990) and the Salt Range (Law and Baqri 2003). Most core preparation was done at these quarries for ease in transport. Crested ridges are more commonly found at these quarry sites than at Indus habitations (Allchin 1979). However, most Indus habitations have some crested ridges, presumably because the crest was made at the quarry, but only removed at the habitation or because new

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crests were made in core rejuvenation. A core pre-form with three crests was retrieved from the original excavations at Mohenjo-Daro (Cleland 1977:35 and 212), which indicates that each core may have utilized multiple initiation ridges. Providing multiple crested ridges on cores may also have served to aide city-dwelling consumers who may have had less advanced blade production skills. Since it is easier to remove a blade from a prepared core than to prepare the core for blade removal, preparing crested ridges before transport provided a service to consumers. That is, cores reached cities in a "ready-made" state.

Although the Indus and Deccan Chalcolithic sites both use crested ridges, it appears that they are used for different reasons. Indus blades and cores are the longest of the subcontinent. Cleland's study found that the average length of Indus blades is 56.8 mm (Cleland 1977:231) and Indus cores is 57.5 mm (Cleland 1977:232). According to this study, the average length of Gilund and Bagor blades, by contrast, is only 11.5 mm and 8.8 mm respectively; the average length of their cores are 27.1 mm and 18.4 mm, respectively. In the Indus, the inhabitants utilized long blades that they snapped into appropriate lengths for hafting (Inizan and Lechevallier 1997). The longer blades perhaps allowed blades to be wider, as well, or resulted from the preparation of cores away from habitation sites, as well as hafting preferences.

In the Deccan, crested ridges were not used to increase length. Instead, they were used to aid in the preparation of small, rounded, river cobbles that were favored in the Deccan Chalcolithic and in much of the Southern Neolithic. Because the material is rounded, there are no natural ridges that can be used to initiate the first blade. Removing the sequence of flakes to make a crested ridge renders the stone usable.

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In southeastern Rajasthan, two types of raw material are mainly used. The majority is non-river-rolled quartz which has plentiful natural ridges. The other is chert and chalcedony which comes in the form of large river-rolled cobbles or in chunks from chert beds. The large cobbles can be simply split to create appropriate ridges for blade formation and the chunks come with natural ridges, precluding the need for the crested ridge.

The blades and cores of Rajasthan and Gujarat appear to be among the smallest of South Asia, which also means that crested ridges are not necessary for their production. Sufficient raw material for the creation of larger blades and blade cores was readily available. Unlike the inhabitants of the Deccan, they were not limited by the size of tiny river nodules. The production of small blades was shaped by other factors like the method of hafting and the production of microlithic tools. We know from ethnoarchaeological work in other regions that groups who live in close proximity frequently use similar lithics that are hafted differently (Weedman 2006). In South Asia as well, the complete sickle found at Mehrgarh (Lechevallier 2003) differs from the hafted blade found at Nagda (Banerjee 1986). Perhaps the hafts in Rajasthan and Gujarat are also unique. The desired end product can also affect lithic length. For example, in Rajasthan and Gujarat, many blades were transformed into microliths, so extra length may not have been necessary.

Alternatives to the Crested Ridge

In their comparison of Late Stone Age sites with Neolithic-Chalcolithic sites (their terminology), Allchin and Allchin (1974) examine two features: blade to tool ratios and core preparation technologies. They note that primary and secondary crested ridge

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flakes have “only rarely been recorded” and that this can only partially be attributed to field collection methodologies. Instead, the “absence of undisputed guide flakes at some of these sites…means either that blade cores were prepared by other means, or that the technique was so far from the model we have described[12] that those by-products are not recognizable. Both these explanations appear to be correct” (Allchin and Allchin 1974:55). The Allchins then point out that natural ridges were frequently used in these regions due to the raw material as well as “artificial causes.” They conclude that the Late Stone Age industry in this region, “comes very close to that of the Neolithic-Chalcolithic cultures, with which it shows every sign of a close and continuous relationship” (Allchin and Allchin 1974:55). In sum, the Allchins’ discussion points to core technology in Central India as unique from other regions, but similar between microlithic scatters and more permanent settlements.

Ajithprasad also proposed alternative methods for blade core initiation. The blade cores from pre-ceramic levels of Pithad, a site dated only through ceramic sequences, had unusual cores. Ajithprasad writes, “The most striking feature of the Pithad Mesolithic industry is that the microlithic assemblage has revealed the evidence of an innovative method adopted by its stone knappers in which large flakes were slashed into two pieces and converted into cores for removing microblades (Ajithprasad 1992)” (Sonawane 2002).

Core Studies in South Asia

Lithic studies in South Asia for sites occupied in the Holocene have largely focused on blade and tool morphology. Special attention is paid to microlithic tools,

[12] They are referring to the crested ridge technique here.

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especially geometric tools. Some assemblage descriptions also include measurements or a notation of raw material. While these studies have been fruitful, other avenues of research have been largely overlooked. Core production strategies are among these. In fact, many assemblage descriptions do not even note the presence of cores or any non-blade, non-tool lithics. However, some researchers have considered core production and the results of their work are presented here. Most notably is the work of French researchers investigating the use of pressure debitage in various regions. Of those studies that do mention cores, most employ only a basic typology of flake core or blade core (e.g. Rissman and Chitalwala 1990), however, several attempts have been made to create more substantial typologies.

Work by French researchers has brought to light the use of pressure debitage at most sites occupied during the Holocene (Inizan and Lechevallier 1990, 1995; Pelegrin 1994). In some cases, it appears that a copper tipped instrument was used to remove blades (Anderson-Gerfaud, et al. 1989; Inizan, et al. 1994). These attempts to recreate the *chaîne opératoire* of blade production in South Asia have contributed greatly to our understanding of core and blade production.

Core Typologies

Allchin et al. (1978:129) discuss eight different kinds of cores that can be found in the Paleolithic and Mesolithic; one of these is the blade core, which they argue is unidirectionally worked and, "which can occasionally be described as cylindrical or pyramidal, but more often they are worked round two or three sides to approximate to one or other of these forms" (Allchin, et al. 1978). However, their drawings for these two shapes show cores that are only worked on a limited part of the core; they are not true

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cylindrical or pyramidal cores. They add that, "Both blades and blade cores are distinct from those of stone industries associated with Mesolithic or later settled cultures by their more pronounced bulbs of percussion and larger size" (Allchin, et al. 1978:320).

In *Stone Age Tools*, Sankalia argues that blade cores are "generally cylindrical and fluted" (Sankalia 1982: 32). He distinguishes between three core shapes, each of which is determined by the shape of the distal end of the core. His three shapes are: pointed or conical (convergent blades), flat-based (parallel blades), chisel or oblique-ended (parallel blades) (Sankalia 1982:32). In his idealized illustrations of these blade core shapes, the cores are all cylindrical. However, he does note that there are two kinds of pre-forms: tabular for quarry material and cylindrical for material from riverbeds. He suggests that the creation of a crested ridge is required for the initiation of either type of core.

A study of Upper Paleolithic cores from Patne, also in central India, found that the crested ridge technique was used, but that some cores had up to three platforms (Sali 1989:58). The cores are described as "mostly prismatic, a small number of conical and cylindrical examples also being present" (Sali 1989:58). However, the core typology employed appears to have included four categories: fluted, with crested ridge, nodule, or flake core (Sali 1989:62). The site also had many burins, the illustrations of which indicated that they may have been used to produce blades.

At the central Indian Chalcolithic site of Dhatva, four categories of cores were noted based on when the core was rejected. The typology considers factors such as level of preparation, cortex, and intensity of use (Mehta 1975:23). A simultaneous core shape typology was also applied (Mehta 1975:25). Jayaswal and Pant (1973) also present a

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core typology in order to determine the manufacturing techniques employed in the Paleolithic. They suggest a seven-part core typology based on level of platform preparation.

At the site of Langhnaj, the cores were divided into two classes: "(a) cores having irregular flake scars, (b) cores bearing longitudinal parallel flake scars" the latter of which could have produced blades (Sankalia 1949:32). Sankalia also notes that "There are some cores, however, which by subsequent trimming, have been turned into tools such as one- or two-ended scrapers and sidescrapers, while a few have been made into fine thick borers, having a fan-shaped body, curved beak-like point, and a thinner cylindrical butt-end (with a flat base), purposely so trimmed for hafting into a wooden or bone handle" (1949:32).

Some core studies are not typological, but descriptive. For example, the presentation of lithics for the Upper Paleolithic site of Mehtakheri in central India says that many blade cores were made from chert and chalcedony, they were only worked on a small portion of the core and still retained cortex on the unworked portions, and that some cores had more than one platform (Ghosh 1993). At the Southern Neolithic site of Utnur, Allchin writes that few cores were found, but they appear to have been quite small and produced from "poor quality jasper" and a "river pebble" (Allchin 1961:43). In describing the cores, Allchin writes that they are, "all very small and worked down to the last possible degree. All contain flaws or traces of cortex and appear to be made upon water-worn pebbles. Many of the other tools were made from such pebbles, but some of the larger sections of chert blades must have been made from cores very different in size and material to any we found" (Allchin 1961:45). The smallest core was 13mm long

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(Allchin 1961:45). Sonawane also offers this description of core production from Tarsang Gujarat:

> It seems that the cores were prepared first by primary flaking of the nodules, then the required size of blades were removed from such prepared cores. Some of the cores of good material were used till the core was exhausted. Often the platforms for such punch rest indicated that the flakes were taken from two or three sides before rejecting them. The presence of multiplatformed cores also indicates the same. There are certain number of blade flakes which retained cortex over most of their surface. This observation indicates that sometimes they might have struck off the blades from unprepared cores also. The typical hammers and anvils obviously suggest that they were used for producing blades by indirect method of flaking. (Sonawane 1983:35)

Inizan and Lechevallier also contemplate the way that cores were prepared. In their study of cores from Bagor they write that the cores "had been used to the maximum possible extent...the cores already prepared for the debitage proper have lost a third of their length" (Inizan and Lechevallier 1995:18). They add that, "the surface worked varies between one-fourth and four-fifths of the core periphery, and is most often between a half and two-thirds...The number of bladelet negatives, varying between 3 and 10" (Inizan and Lechevallier 1995:18). Finally, they identify evidence for the use of heat treatment of chalcedony and pressure debitage "most probably done by the hand" (Inizan and Lechevallier 1995:18).

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Table 5.2 Core Typologies in South Asia[13]

Archaeologist and source	Core Typology	Comments
(Sankalia 1982)	Three types of cores: 1.Pointed/Conical (convergent blades 2. Flat-based (parallel blades) 3. Chisel or oblique-ended core (parallel blades) Also two types of performs: Tabular (for quarry material) Cylindrical (for riverbed stone)	Typology based on end (pointed, flat or oblique), which Sankalia believes influences blade length.
(Allchin, et al. 1978:106-9)	1. Core 2. Core tool 3. Boulder core 4. Polyhedral or multi-directional core 5. Unidirectional core 6. Discoidal 7. Levallois 8. Horse-hoof core 9. Pyramidal blade core 10. Cylindrical blade core	Unidirectional core: blades removed in slices Examines cores to make statements about chronology and geography
(Hoffman and Cleland 1977:11)	1. Blade 2. Non-blade 3. Remnants 4. Unidentifiable fragments	
(Sali 1986)	1. Single or double platform 2. Cylindrical, ovaloid, conical, elliptical 3. Crested ridge present or absent	Sali mainly describes the features of the cores for each period
(Ansari 1988)	Cylindrical Flat Pointed	Describes core prep method

[13] The contents of column 2: "Core typology" are direct quotes from the sources in column 1: Archaeologist and source.

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Table 5.2 Core Typologies in South Asia (continued)[14]

Archaeologist and source	Core Typology	Comments
(Pandey 1987:54)	Flake Blade Micro-blade Discoids	Mahanadi Valley, Madhya Pradesh; Upper Paleolithic
(Alam and Misra 1992:21-34)	Levallois Flake Discoidal Globular Prismatic Pyramidal Shapeless	Typology for Lower, Middle, and Upper Paleolithic for the site of Bhimbetka
(Varma, et al. 1985:61)	Exhausted Fragment Single Platform Double Platform Flake	Typology for the site of Damdama
(Jayaswal and Pant 1973:39)	(i.) unprepared cores; (ii) cores with unprepared dorsal surface and prepared striking platform (iii) cores with preliminary preparation on dorsal surface with unprepared or prepared striking platform; (iv) prepared cores with unprepared or prepared striking platform (v) Levallois cores; (vi) Mousterian cores; and (vii) blade-cores	Paleolithic

[14] The contents of column 2: "Core typology" are direct quotes from the sources in column 1: Archaeologist and source.

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Table 5.2 Core Typologies in South Asia (continued)[15]

Archaeologist and source	Core Typology	Comments
(Mehta 1975:23-5)	I. cores rejected after primary trimming II. Cores rejected after taking a few flakes III. Cores rejected after using them till they had become flattened. They show parts of cortex. IV. Cores worked from more than one platform Core shape typology: Quadrilateral Semitriangular Rough conical Thin Cylindrical	
(Gardner and Martingell 1990:4-5)	flake core for flakes (no faceted butts) disc cores producing multi-facted dorsals and butts micro-blade cores for bladelets	Late glacial and mid-Holocene sites
(Lechevallier 2003)	Ebauche or Flake or Blade Blade cores are described instead of typed, but some descriptions include prismatic, "en mitre," pyramidal, cylindrical, and conical	For the site of Mehrgarh

Discussion

In this chapter, an overview of chronological and regional variation of lithic assemblages within South Asia has been presented. While multiple factors beyond region and chronology influence lithic assemblages, it is important to begin with a basic framework for lithic production.

[15] The contents of column 2: "Core typology" are direct quotes from the sources in column 1: Archaeologist and source.

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Situating Gilund and Bagor within broader chronological and regional frames has been challenging. Bagor was occupied for long durations that spanned multiple chronological periods. The first of these, the Mesolithic, has a troubled history of identification and analysis. It is difficult to compare the early assemblages from Bagor to most other “Mesolithic” sites for the simple reason that many of these sites are poorly dated. Sites that appear to be aceramic microlith scatters on the surface could have been occupied at any point from the late Pleistocene though the middle of the Common Era. Therefore, it may not be appropriate to compare those assemblages to the assemblages from Bagor.

The later occupations at Bagor and the occupations at Gilund clearly overlap in time with each other and many other sites in Southeast Rajasthan and beyond. Comparing these assemblages is much easier and has been productive; the comparative project opens up new avenues of research.

It has become clear that cores and core production have been little studied in South Asia. New core typologies have been constructed for each research project and it can be difficult to make comparisons between sites. Because cores provide much information about technological practices and strategies, the use of a more unified core typology, as well as the recording of multiple core attributes would be beneficial.

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Chapter 6. Method and Data

Introduction

In this project, three avenues of research were undertaken in order to explore the potential connections between Gilund and Bagor. First, the extent to which the material landscapes of Gilund and Bagor overlapped was examined. Second, evidence for similar technological practices was sought. Finally, an attempt was made to identify the presence of overlapping skill sets. This chapter presents the methods used and data collected for each of these pathways.

In order to determine to what extant Gilund and Bagor shared a common landscape, a targeted survey was undertaken to identify potential stone raw material sources. This was paired with a visual analysis of the raw material from the source samples and site collections. Through this research, an attempt was made to identify the raw material sources used by both sites. Identifying the potential raw material sources for each site created a suitable framework for determining the overlap between the material landscapes of Gilund and Bagor.

Second, insights into technological practices were sought through the analysis of the lithic assemblages. A full typological and attribute analysis was undertaken towards this end. Lithic assemblages vary according to practices that include (but are not limited to) mobility, subsistence, and craft production. Thus, this study focused on general descriptions like expediency as well as the extent to which specialized lithic tools such as blades and drills were produced.

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Finally, evidence that Gilund and Bagor shared technical knowledge and a common skill set was sought through the examination of blade core production strategies. Since there are multiple ways to prepare blade cores, evidence for similar strategies and approaches was sought. Towards this end, a detailed blade core typological and attribute analysis was undertaken.

Field Survey

During excavation it became apparent that the majority of the lithics for both sites were made of locally available raw materials, with quartz being the favored material. Sankalia et al. (1969) and Misra (1973) have suggested that the cherts and chalcedonies from Ahar and Bagor were obtained from the nearby Banas and Kothari rivers respectively. Some lithics from Gilund and Bagor bore evidence of river-rolling on non-worked portions, lending support to this hypothesis. However, it was suggested that other lithics may have been brought in from further distances (Khanna 1992). For a mobile community like Bagor, it would not be unusual to travel with a "lithic tool kit" (Kuhn 1994) that would be largely made of raw materials encountered during the course of the journey (Binford 1979) or through special procurement trips (Gould and Saggers 1985). Even a site like Gilund could potentially acquire raw materials from distant locations. The field survey was conducted with the intention of locating potential chert and chalcedony sources for the lithics at Gilund and Bagor.

Several geological maps of the region were studied to identify potential chert and chalcedony sources. These included District Resource Map I. (Geology and Minerals) for both Rajsamand District and Bhilwara Districts published by the Geological Survey of India, as well maps presented in Roy and Jakhar (2002) and Gupta et al (1997). Maps

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published by the Survey of India indicated the location of lime kilns and provided topographical and other geographical information. United States Army maps for India NG43-14 and NG43-10 were also used. In addition, several geologists were consulted for their opinions including Dr. R.A. Sharma, Senior Geologist at the Geological Survey of India, Rajasthan; Dr. Chauhan at the Department of Geology, Udaipur (an independent university); and Dr. G.L. Vyas, the Director of the Rajasthan Department of Mines and Geology, Udaipur. They agreed that very little chert was to be found in the region, but that most of it was likely to be found in scattered deposits to the southeast, near the border with the state of Madhya Pradesh.

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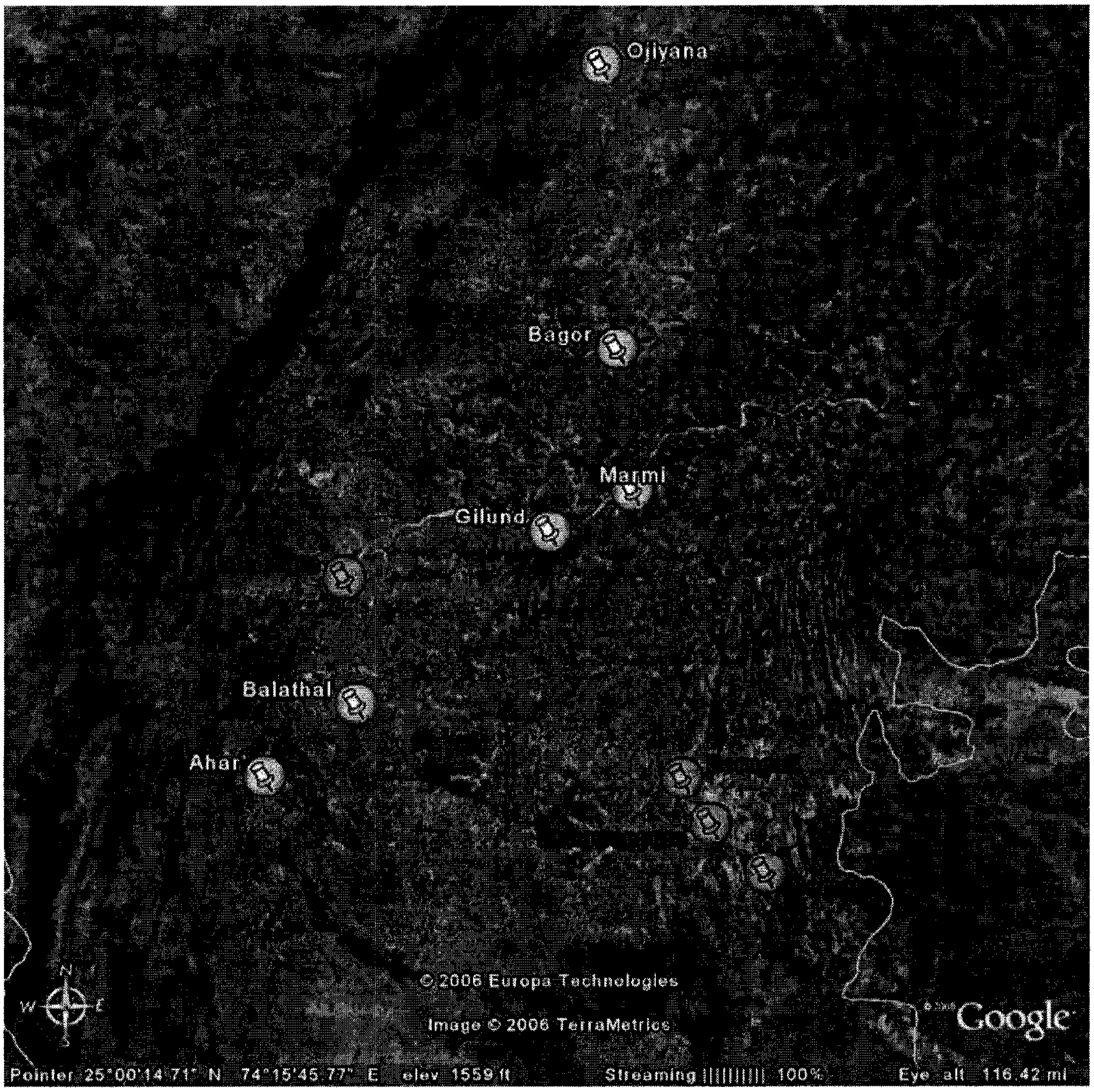

Figure 6.1 Location of Raw Material Sources identified through Survey

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After map review and expert consultation a two-tiered strategy of exploration was created. The first tier included thirteen areas that had been positively identified as chert sources on geological maps. These sites included (in alphabetical order): Bhanwar Mata, Berugati, Bhagwanpura, Chatrikhera, Chitauriya, Kajucheriya, Nathdwara, Semara, Semarthali; and various hills in the Jahazpur Range including Amargala, Asouli, an area near Chanpura mine, and Jikri. The second tier included those areas that were limestone rich and could be potential sources of chert. These included Khirkhera, Railmagra, Sawa, and Surawada. Due to the large number of limestone outcrops in the region, they were divided into two groups: those within 25 km^2 of Gilund and those outside of that area. Every mapped limestone outcrop within the 25km^2 zone (as identified by Dasgupta 2006) was checked and areas outside of that zone were selectively checked.

Each area visited was field checked in three ways. First, an informal walk and quick assessment of the area was undertaken in order to determine whether or not any stone raw materials or artifacts were visible. All tier one sites and those tier two sites with visible chert or chalcedony were divided into transects spaced either 10 or 20 meters apart. The length of each transect was determined by the size of the stone outcrop. Each transect was walked and the presence and density of raw material or artifacts were noted (see Appendix 1: Site Survey Transect Form). After completing the transects, a series of 1x1 m collection units was set up at each locale in order to collect raw material samples and artifacts (see Appendix 2: Surface Collection Form). Each collection unit was assigned a number for later reference. The number and placement of units varied between locales and was determined based on the extent and density of artifacts. The

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collections were targeted, not random and systematic, since they were meant to provide a quick estimation of the presence of cultural material, not the variety of material. In addition to the 1 m x 1 m units, significant artifacts encountered during the course of walking transects were collected and assigned a unit number. Raw material samples were collected at each source of chert and chalcedony. All collected materials are now housed at Deccan College in Pune.

The following raw material sources were identified. Only successful identifications are presented (see Figure 6.1 Location of Raw Material Sources identified through Survey). Locales where no chert or chalcedony was located are not included:

Semara (District Chittaurgarh)

Located approximately 60 km southeast of Gilund, the site of Semara is a low mesa-like limestone hill that rises behind the village of Semara. It is on the southern-most edge of a 7 km long chain of limestone hills. The village of Semara cannot be found on any contemporary road maps; it lies on the Nimbohera-Choti Sadri Road just 3 km south of Semarthali, which is clearly marked on maps. It has been identified in the geological literature as having a non-fossiliferous chert bed. Two small shrines are located at the top of the hill as is a collapsed mobile phone tower at the very north end of the hill. The slopes and top of the hill are frequented by goat-herders and much of the top of the hill is presently under cultivation as are all of the areas surrounding the hill.

The hill is comprised of semi-angular boulders (approximately 1-2 m in size) and small round cobbles and pebbles. The vegetation consists of some low scrubby bushes and light grass. The chertbed lies about halfway up the hill and varies from approximately 1 to 3 m in thickness; it is only present irregularly. The chert is mostly in

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boulder form, although some non-cortical nodules also exist. Red and light brown chert are sometimes found together. In a separate location lies clear and smoky chalcedony along with bluish grey chert. Artifacts are mostly located on top of the hill, although some can be found in the vicinity of the chert and below. The area seems to have been used over long durations because Acheulian handaxes, Levallois cores, and evidence of microblade production are all present. Three distinct locations with concentrations of chert and artifacts were designated as Semara A, Semara B, and Semara C.

Semara A. The density of artifacts at Semara A is quite low; the densest areas were generally classified as have 1-3 artifacts per m^2, although there are higher concentrations within these areas. A total of 4 transects were walked and 32 units were collected at this site. A datum was set behind the back wall of the northernmost shrine on the hill. Four North-South transects that were 20m apart and 150m long, originated from an East-West line projecting from the datum (Transect 1 begins at the datum). The number and length of transects was determined by the extant of the non-cultivated area. Because it was evident that the concentrations of artifacts at this site were quite low all artifacts encountered while walking transects were collected and their location recorded; when more than one artifact was found within 1 m^2, then all were collected as one unit. Several chert and chalcedony samples were collected from different locations on the hill. In all, thirteen complete blades, one proximal blade, six distal blades, fifteen complete flakes, one proximal flake, two medial flakes, fifteen distal flakes, five cores, seven tools, and two pieces of shatter were collected. The cores included one Levallois flake core, three unidirectional flake cores, and one simple (non-fluted) blade core. The tools included one biface and six scrapers (three end, two side, and one double).

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Semara B. Semara B is a continuation of Semara A, although there seems to be a space in between these two areas where the artifact density ranges from very low to none. There is also evidence of microblade manufacture. Twenty transects were walked and 23 units collected. Artifacts collected included thirteen complete blades, two proximal blades, four medial blades, seventeen distal blades, eighteen complete flakes, nine medial flakes, twenty-six distal flakes, seven cores, one core fragment, and three tools. The cores included two Levallois flake cores, one unidirectional flake core, one multidirectional flake core, and three parallel blade cores; the core fragment was a unidirectional flake core. The tools included a burin, a convex side scraper, and a handaxe.

Semara C. Semara C is located at the westernmost edge of the mesa. It is separated from Semara B by a span of very low to minimal artifact density. There is evidence of microblade manufacture. No transects were walked and no units collected due to very low density of artifacts and raw material.

Bagor (District Bhilwara)

The site of Bagor has no visible raw material source in the immediate vicinity. However, Misra (1973) suggested that the stone outcrops across the river may have served as a raw material source for the inhabitants of Bagor. These outcrops were studied and were found to consist largely of micaceous schist. There are a few quartz veins, but no chert or chalcedony is available. It appears that the outcrops have been recently quarried, so it is difficult to determine to what extent they were utilized in the past. However, some microlithic artifacts were noted amongst the outcrops. No transects were walked and no units collected. In addition, Khanna (1988; 1992; 1993) suggests that the

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Vindhyan Hills and Deccan trap formations to the southeast are also possible sources. These areas fall outside of the study area and were not investigated.

Chatrikhera (District Rajsamand)

Chatrikhera is located approximately 3 km from Gilund. Chatrikhera is actually a series of six sites that lie within a 1km radius (DasGupta 2006:105). Chatrikhera VI is a quartz outcrop that was heavily utilized as a raw material source. The majority of the artifacts observed at this site consisted of flakes, although some blades, microlithic tools, and cores (both blade and flake) were identified. A few artifacts of chert and chalcedony were noted. Sixteen transects were walked. The artifacts were found to be low to medium in density.

Nathdwara (District Rajsamand)

Nathdwara is located approximately 40 km to the SW of Gilund. Sankalia reported a Paleolithic site in this region (Sankalia 1956). These hills are close to the Aravallis and hold abundant limestone. Very distinctive chert conglomerate was found, both brown and red, on one hill that overlooks the Banas River. No artifacts were located, but the area is currently heavily quarried for limestone and vast swaths of hills have been removed for lime production. In addition, deforestation has led to significant erosion of the hills.

Banas River

Archaeologists have long thought that the lithic raw material used at sites in this region came from the Banas River. A search of the riverbed near Gilund and Marmi produced a few nodules of chert conglomerate that appear to have washed down the river

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from Nathdwara. While some Gilund and Bagor artifacts are made of this chert conglomerate, the majority are not.

Jahazpur Range (District Bhilwara)

The Jahazpur Range is located approximately 100 km to the northeast of Gilund and includes sites near the villages of Amargala, Asouli, Jikri, and Chanpura. Geological maps indicated that this was probably the most chert rich area of Southeastern Rajasthan. Some very limited pockets of ferruginous chert were located, all of which occurred in conglomerate form with quartz. The quality of the chert was poorer than that found at Nathdwara. In addition, no lithic scatters were identified. Although the investigations were brief, no evidence was found to indicate that any raw materials from Gilund and Bagor came from this area. The soil in this region is very rocky and appears to be unsuitable for farming.

Surawada, Jashma, Railmagra (District Rajsamand)

All known limestone outcrops in a 25 km radius of Gilund were field-checked in order to rule out these areas as chert sources. It was previously suggested that the people of Gilund may have possibly found chert in these areas (Dasgupta 2006), but this hypothesis had not been verified. While no chert was located, it became apparent that quartz is abundant in many places.

Bhagwanpura (District Udaipur)

Bhagwanpura is located between Udaipur and Chittaurgargh. It is known for the limestone quarry located here and for the black chert previously identified by Kumar and

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Srivastava (1992). The chert is present in a large field on both sides of the road, surrounding a village. During the site visit a highly diaphanous chert that ranged from blue-grey to black was identified. A number of microliths were found here as well, including blade cores, blades, and microlithic tools. While most of these were made of the Bhagwanpura black chert, some were made of yellow and red cherts. In all, eight transects were walked and 28 units were collected. Artifacts collected include fourteen complete blades, fifteen proximal blades, twenty-six medial blades, thirty-six distal blades, thirty-two complete flakes, twenty proximal flakes, thirty-two medial flakes, forty-six distal flakes, eighteen cores, two core fragments, twnty-five tools and thirty-seven pieces of shatter. Cores included ten parallel blade cores, seven unidirectional flake cores, one bidirectional flake core. Tools included one trapezoid, one lunate, one burin spall that had been retouched on both edges, one microburin, and one awl. In addition, twnty scrapers were collected including four D-shape, ten end scrapers, and six side scrapers.

Chitauriya (District Udaipur)

Chitauriya is located approximately 10 km west of Bhagwanpura. Red and brown chert can be seen in the fields here. Next to this field is a quartz outcrop, on which sits an occupation with stone walls and Early Historic pottery. Much of the site was destroyed by rock borrowing and soil borrowing. A total of 40 units were collected on the site and in the fields. Microlithic tools, cores, flakes, and blades were all found, mostly made of the local red and brown chert. Some quartz and artifacts made of Bhagwanpura Black chert were also found. Artifacts collected include three complete blades, one proximal blade, seven distal blades, eleven complete flakes, three distal flakes, and nine cores. The

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cores include seven parallel blade cores, one bidirectional flake core and one multidirectional flake core.

Berugati (District Udaipur)

Berugati is located near Chitauriya. It is a small hill range with extensive blonde brecciated chert beds. There are also some blue-black chert boulders near the southern end of the hill and a few dense lithic scatters, some of which had considerable evidence of microlith manufacture. No pottery other than modern sherds was observed. A modern Ashram and a shrine are located near the road. A total of 30 units were collected. Berugati is probably the richest site of all the sites presented here. In all, thirty complete blades, twenty proximal blades, twenty-six medial blades, sixty-three distal blades, one hundred sixty complete flakes, forty-four proximal flakes, sixty-one medial flakes, one hundred twenty-eight distal flakes, twelve cores, five core fragments, forty-five tools, and two broken tools were collected. Cores included five parallel blade cores, five unidirectional flake cores, one bidirectional flake core, and one multidirectional flake core. Core fragments included two unidirectional flake cores and three multidirectional flake cores. Tools included four burins, one burin spall, one drill, one notch on flake, and twenty-six scrapers (three double, two D-shaped, five end, sixteen side), while the two broken tools were both side scrapers.

Survey Summary

In all, five chert sources and one chalcedony source that were potentially used by the inhabitants at Gilund were documented as well as another three that probably were not used. The Banas River also may have served as a source of material. Visual

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descriptions of these cherts will be provided in the section on raw material analysis below. One of these cherts—the red or brown chert conglomerate from Nathdwara—can be found in the riverbed near Gilund, but the others cannot as the sources are not upstream from Gilund. Limestone sources near Gilund have also been eliminated as possible chert and chalcedony sources for the people of Gilund and Bagor. Quartz was found to be abundantly available in every square kilometer around Gilund as well as across the river from Bagor.

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Table 6.1 Lithics Collected at Semara A.

Collection Unit	Complete & Proximal		Complete		Medial & Distal		Broken		
	Blade	Flake	Tool	Core	Blade	Flake	Tool	Core	Shatter
1	0	1	0	0	0	0	0	0	0
2	1	0	0	0	0	0	0	0	0
3	0	0	1	0	1	3	0	0	0
4	2	0	0	0	1	1	0	0	0
5	0	0	0	0	0	1	0	0	0
6	0	0	0	0	0	0	0	0	1
7	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	1	0	0	0
9	0	1	0	0	0	1	0	0	0
10	1	0	0	0	0	1	0	0	0
11	1	0	0	0	0	0	0	0	0
12	1	0	0	0	0	0	0	0	0
13	0	1	0	0	0	0	0	0	0
14	1	2	0	1	0	1	0	0	0
15	0	0	0	0	0	0	0	0	0
16	0	0	0	1	0	0	0	0	0
17	0	2	1	0	1	0	0	0	0
18	0	0	1	0	0	0	0	0	0
19	1	0	0	2	1	3	0	0	0
20	0	1	0	0	0	1	0	0	0
21	0	3	0	0	0	0	0	0	0
22	0	0	1	0	0	0	0	0	0
23	1	0	0	0	0	0	0	0	0
24	2	2	0	0	0	0	0	0	0
25	0	0	1	0	0	0	0	0	0
26	1	0	0	0	0	0	0	0	0
27	1	0	0	0	0	0	0	0	0
28	0	0	0	0	1	0	0	0	0
29	0	1	2	0	1	3	0	0	1
30	0	0	0	1	0	0	0	0	0
31	0	2	0	0	0	1	0	0	0
32	1	0	0	0	0	0	0	0	0
Total	14	16	7	5	6	17	0	0	2

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Table 6.2 Lithics Collected at Semara B.

Collection Unit	Complete & Proximal		Complete		Medial & Distal		Broken		
	Blade	Flake	Tool	Core	Blade	Flake	Core	Tool	Shatter
1	1	4	0	0	1	1	1	0	0
2	0	0	0	1	0	1	0	0	0
3	2	3	0	0	0	2	0	0	0
4	1	1	0	0	0	2	0	0	0
5	0	1	1	0	0	4	0	0	0
6	1	0	0	0	3	6	0	0	0
7	1	1	0	1	0	1	0	0	0
8	1	0	0	1	0	1	0	0	0
9	0	1	0	0	6	2	0	0	0
10	0	2	0	0	1	1	0	0	0
11	0	1	0	0	0	1	0	0	0
12	1	1	0	0	0	0	0	0	0
13	0	0	1	0	0	0	0	0	0
14	0	0	0	1	0	0	0	0	0
15	1	0	0	0	0	0	0	0	0
16	0	1	1	1	0	0	0	0	0
17	1	0	0	0	1	0	0	0	0
18	3	2	0	1	2	2	0	0	0
19	1	0	0	0	2	2	0	0	0
20	0	0	0	0	3	2	0	0	0
21	1	0	0	0	2	7	0	0	0
22	0	0	0	1	0	0	0	0	0
Total	15	18	3	7	21	35	1	0	0

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Table 6.3 Lithics Collected at the Site of Bhagwanpura

Collection Unit	Complete & Proximal		Complete		Medial & Distal		Broken		Shatter
	Blade	Flake	Tool	Core	Blade	Flake	Tool	Core	
1	0	1	0	1	1	1	0	0	0
2	0	0	0	1	0	0	0	0	0
3	0	0	2	0	0	0	0	0	0
4	1	2	1	1	1	3	0	0	0
5	1	2	0	1	3	7	0	0	1
6	2	7	1	2	4	6	0	0	0
7	4	5	1	0	3	13	0	0	23
8	2	1	2	2	3	2	0	0	0
9	0	2	1	0	1	4	0	1	0
10	1	6	1	0	2	0	0	0	0
11	0	1	0	0	4	1	0	0	0
12	0	0	4	2	4	1	0	0	0
13	1	1	2	1	5	4	0	0	3
14	1	1	0	0	4	3	0	1	2
15	1	3	0	0	3	4	0	0	1
16	1	4	0	0	2	2	0	0	0
17	1	2	2	0	5	2	0	0	3
18	2	1	0	1	1	1	0	0	0
19	0	1	1	0	1	1	0	0	0
20	0	0	0	1	0	0	0	0	0
21	0	3	1	0	2	3	0	0	0
22	3	3	2	0	3	1	0	0	1
23	0	2	1	0	5	3	0	0	2
24	3	1	0	2	1	2	0	0	0
25	5	3	3	3	4	2	0	0	1
Total	29	52	25	18	62	66	0	2	37

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Table 6.4 Lithics Collected at the Site of Berugati

Collection Unit	Complete & Proximal		Complete		Medial & Distal		Broken		
	Blade	Flake	Tool	Core	Blade	Flake	Tool	Core	Shatter
1	0	0	0	0	0	0	0	0	0
2	2	15	3	1	0	9	0	1	0
3	0	6	5	2	1	4	0	1	0
4	0	1	1	0	6	3	0	0	0
5	1	2	2	0	3	9	0	0	0
6	3	6	5	1	0	3	0	0	0
7	0	13	1	1	5	4	1	0	0
8	1	4	0	0	2	4	0	1	0
9	3	13	0	1	5	10	0	0	0
10	4	8	3	2	2	5	0	1	0
11	0	1	0	0	0	0	0	0	0
12	0	1	0	0	0	0	0	0	0
13	4	3	0	0	6	13	0	0	0
14	7	5	2	1	6	12	0	0	0
15	0	0	0	0	0	0	0	0	0
16	3	15	13	0	4	16	1	0	0
17	8	14	1	0	15	19	0	0	0
18	0	11	2	1	3	5	0	0	0
19	0	5	0	0	2	9	0	0	0
20	2	10	2	0	2	8	0	0	0
21	0	14	3	0	2	10	0	0	0
22	6	15	0	0	7	10	0	1	0
23	4	15	0	1	6	5	0	0	0
24	1	21	1	1	5	19	0	0	0
25	1	6	1	0	7	12	0	0	0
Total	50	204	45	12	89	189	2	5	0

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Table 6.5 Lithics Collected at the Site of Chitauriya[16]

Collection Unit	Complete & Proximal Blade	Complete & Proximal Flake	Complete Tool	Complete Core	Medial & Distal Blade	Medial & Distal Flake	Broken Tool	Broken Core	Shatter
1	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0
6	0	1	0	0	0	0	0	0	0
7	0	1	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0
22	1	0	0	0	0	0	0	0	0
23	0	0	0	2	0	0	0	0	0
24	0	1	0	1	0	3	0	0	0
25	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0
27	0	0	0	2	0	4	0	0	0
28	0	1	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0
33	0	1	0	3	0	0	0	0	0
34	0	1	0	0	1	0	0	0	0
35	1	3	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0
37	0	0	0	0	1	0	0	0	0
38	0	0	0	0	1	0	0	0	0
39	1	1	0	1	0	0	0	0	0
40	0	2	0	0	0	0	0	0	0
Total	3	12	0	9	3	7	0	0	0

[16] Note: Many collection unites appear to have no artifacts collected; In these units raw material samples and ceramics were collected.

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Figure 6.2 Handaxe from Semara B, Collection Unit 16

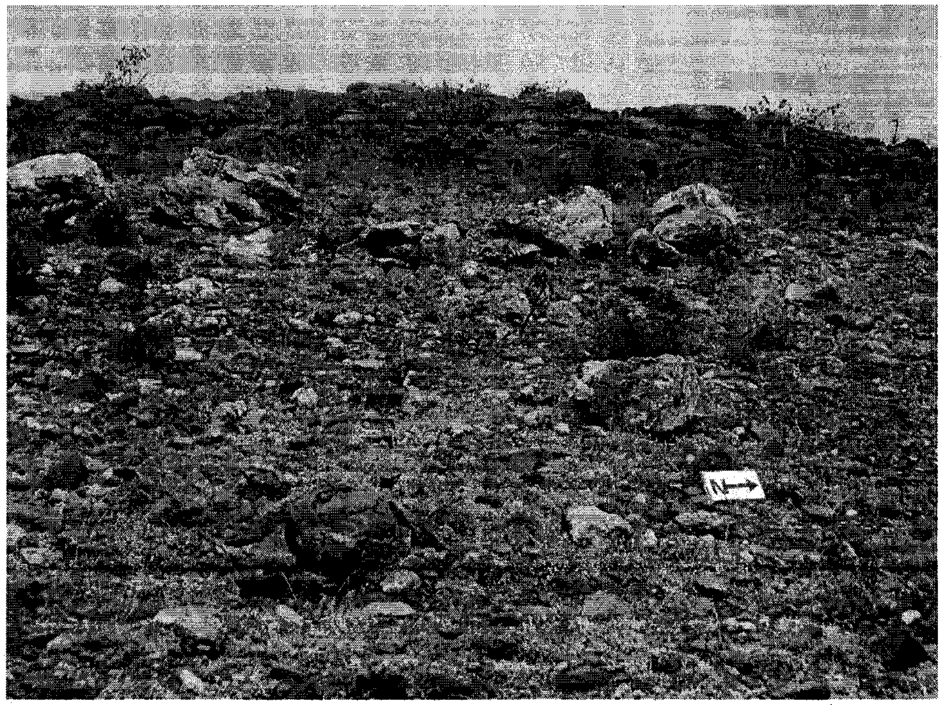

Figure 6.3 Cluster of Chalcedony boulders at Semara B

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Figure 6.4 Quartz outcrop across the river from Bagor

Figure 6.5 Chatrikhera VI, Quartz outcrop

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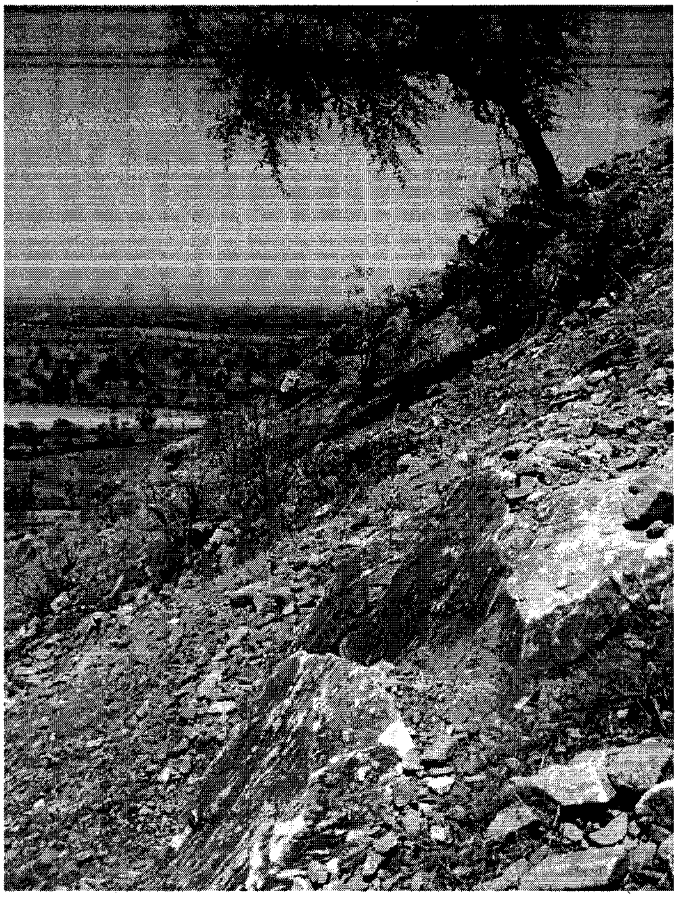

Figure 6.6 Nathdwara Hill with Banas River in background

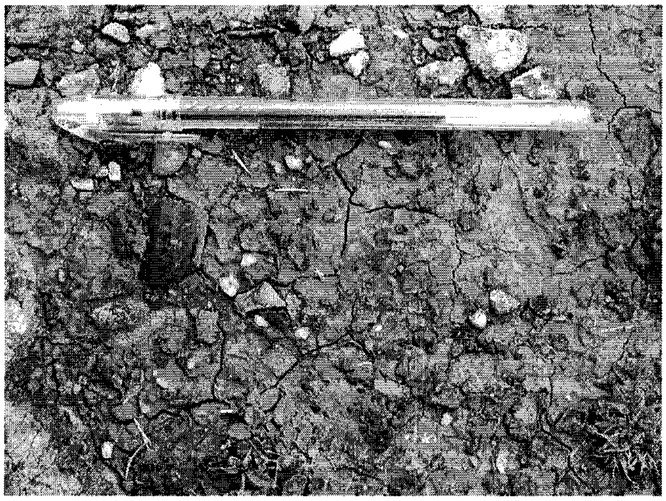

Figure 6.7 Blade Core of Bhagwanpura Black Chert at Bhagwanpura

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Gilund Excavations

The site of Gilund was excavated over five seasons between 1999 and 2005. Several trenches were placed on both mounds (GLD1 and GLD2), however, the excavations mainly emphasized GLD2. In all, nearly 200 5 m x 5 m trenches were laid out and excavated to various depths (see figure 6.8, trenches at Gilund). Archaeologists generally dug according to stratigraphic levels; when a stratigraphic level exceeded 5 cm, the soil was removed in 5 cm arbitrary levels. With the exception of special finds ("antiquities" or "small finds"), the artifacts from these levels were collected together as a "dirt lot" and given one lot number. A detailed form recording important excavation details was filled out for every dirt lot.

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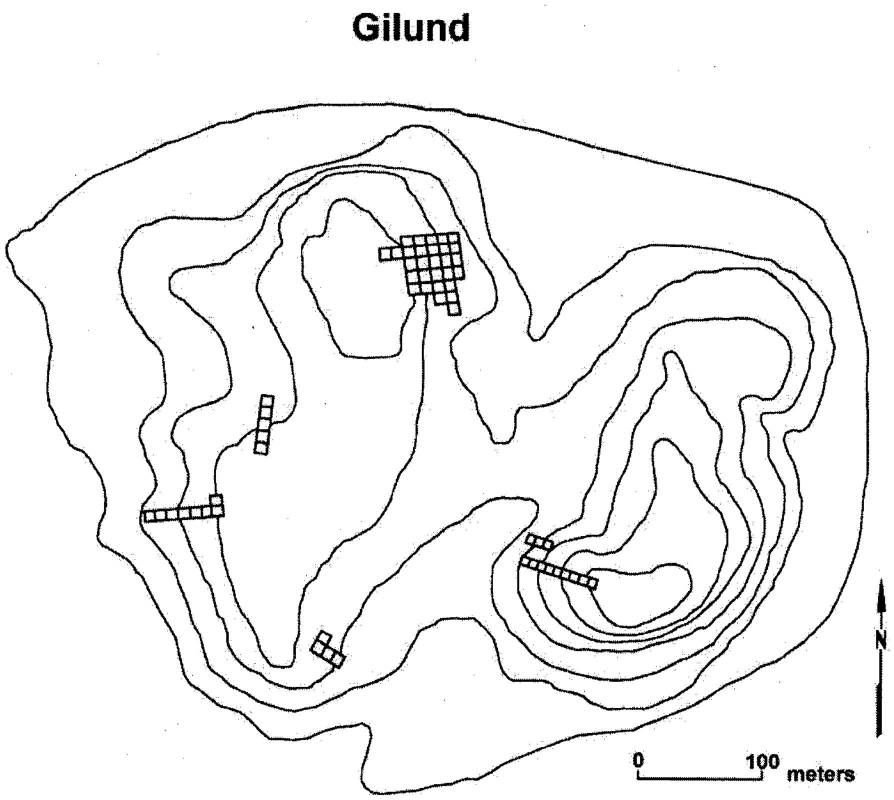

Figure 6.8 Trenches at Gilund.

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Figure 6.9 Workers Screening at Gilund.

During excavation screens with a small mesh (slightly less than 1/8") were employed (see figure 6.9, Workers Screening at Gilund). The decision to screen or not screen a given dirt lot was made by each excavator in consultation with the area supervisors. For most dirt lots, 100% of the soil was screened; only those lots considered to be highly disturbed and of mixed context were not screened. All visible artifacts were collected by the screeners and placed in paper or plastic envelopes according to artifact type. All artifacts in lithic envelopes were then counted before being placed in storage.

Although lithics were found scattered throughout the two mounds at Gilund, few were recovered from GLD1 and most were recovered from the northeastern side of GLD2. Trenches 24, 27, 38, 39, 40, and 41, located just south of the parallel walls, were particularly rich. Much of the soil in the upper layers of these trenches was deposited from above; two gullies ran roughly from west to east through the trenches. Artifacts

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found in mixed contexts were excavated and stored separately, and were not included in the analysis presented here. Many lithics were found in relation to two partial mud-brick walls that were exposed approximately one meter below current ground surface in trenches 39 and 40. Additional lithics were found in between and under the parallel walls.

Bagor Excavations

The site of Bagor was excavated in 2001 by a small crew from the Gilund team. Five 5 m x 5 m trenches were excavated. The same excavation techniques used at Gilund were also employed at Bagor, including the lot number and screening system. All Bagor data presented here comes from trench 1A (5 m x 5 m), the index trench. While the north and south halves of this trench were dug separately, the artifacts for each stratum are combined in this analysis. There are four strata at Bagor: 1, 2, 3, and 4. Stratum 1 begins at the surface and each additional stratum is located underneath. Stratum 1 begins at the surface and varies from 8 to 13 cm thick (because of the uneven nature of the surface). Since this stratum is largely disturbed and includes modern and early historic deposits, it is not included in this analysis. Stratums 1 and 2 roughly correspond to Misra's Period III, which is comprised of the layers nearest to the surface and which he dates to 600 BC-AD 200. Stratum 3 roughly corresponds to Misra's Period II, which he dates to 2800-600 BC. Stratum 4 represents the initial occupation and corresponds to Misra's Period I, which he dates from 5500-2800 BC. While Misra originally excavated nearly 1.5m below the levels of earliest occupation, the new excavations ended with the first recognition of sterile soil. As a result, they are not as deep as Misra's original excavations.

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The previous excavations of Bagor were much more extensive and included an initial test pit of 3 m x 2 m, four additional 3 m x 2 m units in following seasons, as well as a central 20 m x 10 m unit (Misra 1973). Tens of thousands of lithics were recovered from the original excavations. Quartz, (89%), chert (20%), and chalcedony (1%) make up the bulk of the raw materials (Misra 1971a). The lithic collections from the first excavations at Bagor have been studied by Misra (1973; Misra 1982), Khanna (1988), and Inizan and Lechevallier (1995).

Misra analyzed the collection from the initial test trench using a microlithic typology based on Clark and Sharma (1983). The overwhelming majority (95.77%) of the 8546 “worked pieces” were “unfinished;” however microliths (3.55%) and core and flake tools (.068%) were also present (Misra 1971b:242). According to Misra (Misra 1973:98), transverse arrowheads are unique to Bagor and are rarely found across India. He suggests that symmetry is a distinctive feature of the Bagor lithics and that they are similar to other sites in Rajasthan and Uttar Pradesh (1973:98).

Inizan and Lechvallier’s study of nearly 1% of the entire Bagor collection indicates that lithic production techniques at Bagor appear to have changed little over the millennia (Inizan and Lechevallier 1995). These techniques include heat treatment and pressure debitage of chalcedony and the production of whole blades with parallel edges and ridges for the manufacture of geometric and non-geometric tools. These authors argue that the number of cores found onsite is unusually low and suggest that the discarded chalcedony cores may have been reused as bead blanks. Inizan and Lechevalier also note that they found no bullet cores and that the back of the cores

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usually was cortical. Finally, these authors suggest that the cores were probably held in a vise during the pressure removal of blades (1995: 18).

Finally, Khanna (1988) performed a typological and edge-wear analysis of 400 Bagor tools at both low (100x) and high (400x) magnification. While he found some traces of sickle polish from plant processing, most microliths and blades had no sign of wear or minimal sign of wear. This phenomenon may be attributed to the ability of chalcedony and heat treated chert to obscure wear patterns.

Collections Analysis

The collections at Gilund were analyzed over the course of two seasons: Summer 2005 and Summer 2006. The study season of 2005 sampled all excavated trenches at Gilund while the 2006 study season focused exclusively on attribute analysis of the cores. Since Trenches 24, 27, and 38-41 were the most lithic-rich trenches of the site, a random sample of artifacts from these trenches were selected for analysis. All other trenches had fewer than 60 lithics.[17] Therefore, 100% of lithics found in all other trenches were analyzed.

Selection of Samples

This study focused on a limited sample from each site in order to ensure contemporaneity. Since Bagor was first inhabited at 5500 BC while Gilund was first inhabited at 3000 BC, the earliest levels from Bagor were excluded from analysis. Similarly, Bagor was abandoned by 200 AD, while Gilund continued to be occupied until the first millennium BC and even later on GLD1. Later levels of both sites were

[17] Excluding shatter, medial and distal non-backed, non-truncated, or non-retouched flakes and blades.

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excluded from analysis. For the purposes of this study only lithics from layers that appear to be contemporaneous to both sites were included. For Bagor, all lithics from trench IA, stratum 3 were included. For Gilund only lithics from GLD2 were sampled including lithics recovered from stratums 2, 3, 12, 21, 30, and 31 (see Figure 6.10 Gilund Trenches with Lithics Included in the Study and Table 6.6 Count of Sample Lithics per Trench at Gilund). In addition, all lithics collected from trenches located in and around the parallel walls were included since these areas also were occupied simultaneously. All other lithics were excluded from this comparison since they were collected from non-contemporaneous time periods or disturbed contexts. In all, 1564 lithics from Bagor and 2830 lithics from contemporaneous contexts at Gilund were included in the study sample. These numbers do not include shatter, or medial and distal pieces except for tools or backed, retouched, or truncated blades or flakes. The study sample included all contemporaneous complete and proximal flakes and blades along with medial and distal backed, retouched, or truncated flakes and blades. All complete and broken tools and cores were also included.

One of the challenges presented by comparing two sites of very different occupational histories and excavation intensities is that different soil volumes were excavated for each site. As a result, unweighted comparisons are not appropriate. For example, to say that 91 tools were found at Gilund and 94 at Bagor does not indicate which site had proportionately more tools since substantially more soil was removed at Gilund (possibly 20-50 times more soil).[18] The statistical analyses presented here were undertaken with this in mind.

[18] Soil volumes were not recorded for either excavation.

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Table 6.6 Count of Study Sample Lithics per Trench at Gilund

Trench #	Count (Complete and Proximal Only)
12	3
13	6
6	1
7	1
8	2
9	57
16	9
18	50
19	1
24	3
25	2
27	950
31	1
32	1
33	2
34	1
35	30
38	391
39	475
40	309
41	509
64	2
65	11
68	3
69	4
70	2
201	3
202	1
Total	2830

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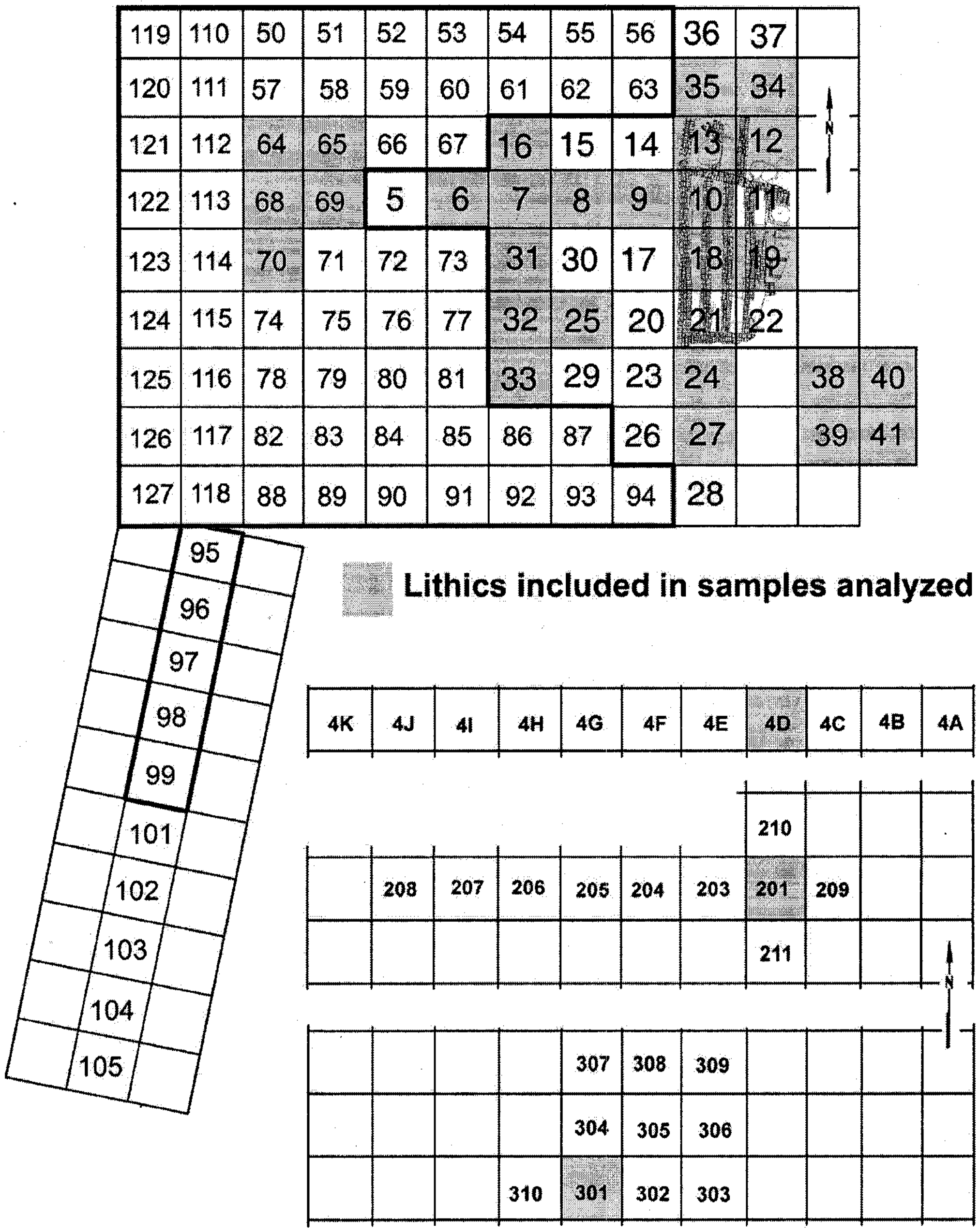

Figure 6.10 Gilund Trenches with Lithics Included in the Study.

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Methods of Lithic Analysis

Separate analytical methods were employed for broken and whole artifacts. Whole artifacts were recorded and analyzed individually and a complete set of data was collected for each. With the exception of metric measurements, complete data also was collected for proximal pieces of artifacts as well as the medial and distal parts of tools, backed pieces, truncated pieces, and retouched pieces. All medial and distal artifacts with the exception of tools and backed, truncated, or retouched pieces were separated by raw material, then counted and weighed as a group for each lot. Shatter was separated by raw material, then counted and weighed as a group for each lot. All data was entered into a database using Entrer Trois archaeological software designed by Shannon McPherron (Max Planck Institute fro Evolutionary Anthropology, Leipzig) and Simon Holdaway (University of Auckland, New Zealand). All measurements were taken to the .01 mm with Mitutoyo absolute digimatic calipers that were connected to the computer through a USB port, which enabled measurements to be entered directly into the database. All weights were taken on an Acculab GSI-200 scale that measures to the .1 gram and then hand entered into the database.

Data collected is shown in Table 6.7 Attributes Recorded. All artifacts were assigned a type according to a modified version of Misra's typology for Bagor (Misra 1973). However, the definition of blades, burins, and microburins differs slightly from Misra's original typology. For the purposes of this study a piece was identified as a blade if it had parallel sides (or nearly parallel sides in the case of quartz, which frequently breaks with imperfect edges), *even if the length was not twice the width.* Under Misra's typology, artifacts had to meet both criteria in order to qualify as a blade. Because the

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length and width of all complete artifacts were recorded, and because it appeared that many parallel sided blades fell just short of the 2:1 ratio, it was decided to record only the presence or absence of parallel sides. After artifact analysis, during the data analysis phase, it was possible to determine which of these artifacts were longer or shorter than the 2:1 ratio. Burins and microburins are not discussed by Misra in his initial report, but were included in the Gilund and Bagor typology.

A number of attributes were recorded for complete and proximal flakes and blades including descriptions of platforms, dorsal ridges, backing, truncation, retouch, and raw material (to be discussed below). Platform descriptions were recorded as part of the investigation into core production techniques. The number of ridges was recorded because some lithic analysts strictly adhere to a "2-ridge" minimum qualification for a lithic to be considered a blade and not an elongated flake. While this qualification was not used in this study, the ridges were recorded in order to make the data comparable to other studies. Location and type of backing were recorded in order to provide information on hafting techniques. Most descriptions of lithic assemblages from South Asia list types but not attributes; those that do usually only record raw material and size. As a result, it is difficult to compare assemblages beyond type, raw material, and size distributions. The attributes in this study were recorded in part to provide a basis of comparison for future researchers.

As mentioned above, all measurements were taken with Mitutoyo digital electronic calipers that entered measurements directly into the database and allowed for accurate and fast data entry. Length, width, and thickness were taken for all complete artifacts. Length was measured from the point of percussion to the furthest possible

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point. Width was taken at the halfway point of the length. Thickness was then measured at the same point as width by rotating the artifact 90°. For cores, the artifact was positioned such that length was taken on the side of the longest removal in the direction of the length of the blade or flake removed. Width of the core followed the same direction of the width of the blade or flake removed and was taken at the halfway point of the length. Thickness was measured by rotating the artifact 90° from the position in which width was measured. For many cores, both flake and blade, this resulted in the thickness being larger than the width (see below for further discussion of this phenomenon). However, it was decided to use this positioning strategy because it appeared that many cores were worked from front to back in a single direction. Thus, width measured in this way had a greater potential for providing a greater indicator of intensity of blade production. Tools—both broken and whole—were measured along their longest edge to determine the length. Width and thickness were then taken at the halfway point, with the exception of triangles, where the width was measured at the apex of the triangle. Medial and distal pieces of flakes and blades were not measured, but were weighed. Similarly, proximal flakes and blades were not measured for length, width, and thickness with the exception of backed or truncated pieces. All proximal pieces were weighed. Width and thickness were taken at the widest point. Shatter was not measured.

In addition to the above, a series of further attributes were recorded on a sample of cores from Gilund and Bagor. The attributes recorded are presented in Table 6.8 Core Attributes Recorded. The data collected were designed to answer a series of questions

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about the way the cores were prepared prior to blade removal, how blades were removed, and the way in which the core was reduced.

Finally, the raw material and a number of raw material attributes were recorded for each lithic as well as for samples from the survey sites. These attributes are presented in Table 6.9 Raw Material Attributes Recorded. Raw material was recorded for two reasons. First, raw material influences lithic production in multiple ways (see Chapter 3 for an elaboration), not the least of which is the size of the artifact. Second, through the recording of raw material, it was possible to begin to make connections between artifacts found at Gilund and Bagor and the raw material samples collected from potential quarry sites. Through the analysis of the raw material samples, a number of raw material designations were developed, such as "Bhagwanpura Black." These designations are shorthand appellations for constellations of attributes that include color, translucence, luster, and inclusions; they refer to the site where the raw material may be found. When analyzing the artifacts some common chert types were recognized that had not been identified through the survey for raw materials. For ease of analysis, a designation was also given to these chert types. "Anonymous cream," "crazy grey," and "bubblegum" are examples of these cherts.

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Table 6.7 Attributes Recorded (excluding raw material and core attributes)

General Data	Options	Conditions
Lot number	Assigned in the field by excavators	All artifacts
Suffix	Consecutive numbers assigned to each artifact within a given lot, beginning with 0001	All artifacts
Dataclass	Blade, flake, tool, core, shatter	All artifacts
Broken Fragment	complete, proximal, medial, distal, fragment	All artifacts
Tool type	burin, microburin, scalene-triangle, isosceles-triangle, trapeze, trapezoid, point, drill, lunate, rhomboid, burin-backed, transverse-arrowhead, 3-point-bladelet, scraper, oblique-blunted-point, notch-on-blade, notch-on-flake, other	Tools only
Scraper type	End-straight, end-concave, end-convex, side-straight, side-concave, side-convex, double-straight, double-concave, double-convex, on-core	Scrapers only
Retouch	Absent, one-edge, two-edges, end, one-edge-end, two-edges-end	Flakes, blades only
Backing	Absent, one-edge, two-edges, end, one-edge-end, two-edges-end	Flakes, blades only
Type of Backing[19]	Inverse, obverse, burin, inverse-burin, obverse-burin, inverse-obverse, inverse-obverse-burin, ridge, obverse-notch, inverse-notch, both-notch, saw	Backed flakes and blades only
Location of Backing[20]	Full, proximal, distal, medial, proximal-to-distal-retouch	Backed flakes and blades only
Truncations	absent, straight, angle, notch, convex, other	Flakes, blades
Platform type	unprepared, cortical, flat, linear, dihedral, multifaceted, punctiform, flaked	Complete proximal blades and flakes only
Dorsal scars	unprepared-cortical, one ridge, two ridges, three or more ridges, other-prepared, one horizontal ridge, two horizontal ridges, three horizontal ridges, other unprepared, crested ridge, coretab	Complete and proximal blades and flakes only
Length	measured with electronic calipers	Complete, proximal
Width	measured with electronic calipers	Complete, proximal
Thickness	measured with electronic calipers	Complete, proximal
Weight	measured with electronic scale	Complete, proximal

[19] Recorded twice for those pieces with backing on both edges.
[20] Recorded twice for those pieces with backing on both edges.

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Table 6.8 Core Attributes Recorded

Category	Data entered	Conditions
Lot number	Assigned in the field by excavators	All artifacts
Suffix	Consecutive numbers assigned to each artifact within lot, beginning with 0001	All artifacts
Dataclass	blade flake tool core shatter	All artifacts
Core type	flake or blade	All cores
Removal direction	Unidirectional, bidirectional, 90degree, multidirectional, discoidal	Flake cores
Blade bulb scars	Count	Blade cores
Flake bulb scars	Count	All cores
Core shape	wedge-triangle, wedge-trapezoid, cylinder, sub-cylinder, half-cylinder, block, pyramid, sub-pyramid, flat, on-flake, amorphous, flat	All cores
Platform number	1, 2, 3 or more	All cores
Removal direction	Unidirectional, bidirectional, 90degrees, tridirectional, parallel, intersecting-v	Blade cores
Removal location	Front, front-back, front-1side, front-2sides, front-top, front-bottom, front-back-top, front-side-top, all-sides	Blade cores
Platform preparation[21]	single-flake, multiple-flakes, none	All cores
Platform edge prep[22]	none, sm. flakes, grind, point-du-pression	All cores
Body preparation	none, single flake, uniface, biface	Blade cores
Order of prep	platform first, body first, indeterminate	Prepared cores
Initiation	burin, crested ridge, indeterminate, other	Blade cores
Initiation location	on-edge, on-face, indeterminate	Blade cores
Back preparation	Unworked, unworked-cortical, single-flake, multiple-flakes, blades	Blade cores
Back shape	elongated-X, sideways-X, regular-X, square, flat, convex/round, variegated	Blade cores
Butt-wear	Present, absent	Blade cores
Back preparation direction	Unidirectional, bidirectional, 90degree, tridirectional, 4-directions, not-systematic	Blade cores
Bottom preparation	single-flake, multiple-flakes, blades, none	Blade cores
Reason for Discard	hinge, indeterminate, raw material flaw, too small, bad platform, fragment	All cores
Length	measured with electronic calipers	Complete cores
Width	measured with electronic calipers	Complete cores
Thickness	measured with electronic calipers	Complete cores

[21] Repeated for each platform
[22] Repeated for each platform

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Table 6.9 Raw Material Attributes Recorded

Category	Options	Condition
Raw material	Quartz, chert, chalcedony, quartzite, basalt, garnet	Complete and proximal pieces; all backed and truncated pieces; all core fragments
Chert identification	Semara-red, Semara-brown, Semara-dark brown, Semara-mixed, Semara-translucent, Semara-blue, Semara-cream, Bhagwanpura-black, Nathdwara-dark, Nathdwara-red, Nathdwara-brown, Berugati-cream, Berugati-pink-olive, Berugati-grey, Berugati-mottled grey, Berugati-red, Berugati-yellow, Berugati-pink-red, special brown, anonymous cream, anonymous pink, brown-pink, anonymous dark-red, crazy grey, grey-striped, Jashma-red, bubblegum pink, other	Chert only
Chert type	plain chert, brecciated chert, chert-quartz conglomerate, chert-chalcedony conglomerate, translucent chert	
Chert color[23]	identified with Munsell stone color chart	Other cherts only
Chert inclusions[24]	none, mottling, quartz bands, red bands, black bands, white bands, cream bands, quartz, chalcedony, other chert, minerals, black clouds, black veins, white veins, red veins, geode, red dots	Other cherts only
Mottling	color identified with aid of Munsell stone color chart	Mottled chert only
Chalcedony color	clear, milky, smoky, orange, red, orange-red, red-clear, orange-clear, yellow-clear, yellow-red, yellow, patinated	Chalcedony only
Chalcedony inclusions	none, white bands, black bands, moss, specs, orange clouds, red clouds, brown clouds, black clouds, square specs	Chalcedony only
Alteration/heat-treatment	none, burned, patinated, partially-patinated, heat-treated	Chert and chalcedony only
Luster	shiny, medium, dull	Other chert only
Cortex	none, river-rolled, non-river-rolled, cortex-indistinguishable	Chert and chalcedony only
Quartzite color	white, off-white, grey, light-brown, dark-brown, pink	Quartzite only
Quartz quality	very-fine, fine, medium, large, x-large	Quartz cores only

[23] Repeated for each color identified in multi-colored cherts.
[24] Repeated for each inclusion identified in cherts with multiple inclusions.

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General Description of Collections

This dissertation is a comparative analysis of the two contemporaneous sites of Gilund and Bagor. This section compares and contrasts the two collections by presenting a number of simple tables and statistical tests that were performed using Minitab statistical software.

Overview of Types

Four basic types were noted in the study: flakes, blades, cores, and tools (see Table 6.10 Dataclass by site. When all types were compared, the distribution of artifacts was found to be significantly different (Chi-square = 23.351, df=3, p<=0.001). Prior to the start of this project, it had been predicted that Bagor would have more tools than Gilund since it was occupied by a group of people whose subsistence at least partially consisted of hunting, and microlithic tools were presumably hafted into hunting implements. It had also been predicted that Gilund would have considerably more blades than Bagor due to its reliance on agriculture and because contemporaneous permanent settlements in other regions like the Indus and Deccan tend to have strikingly more blades than tools. Bagor does, in fact, have more tools than Gilund (6.0% and 3.2% respectively); however, it also has more blades than Gilund (48.2% and 46.6% respectively). This is a significant difference (Chi square =14.610, df=1, p=0.000). However, the difference between blades and flakes at the two sites is not significant (Chi square= 3.427; df=1, p=.064). The comparison of numbers of tools versus blades and blades versus flakes can be used when considering to what extent the assemblages are

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expedient or formal. The relative expedience and formality of the collections, including types and attributes, will be discussed in chapter 7.

Table 6.10 Dataclass by Site

	BAGOR		GILUND	
	N	%	N	%
Blade	754	48.2%	1318	46.6%
Core	94	6.0%	190	6.7%
Flake	622	39.8%	1231	43.5%
Tool	94	6.0%	91	3.2%
TOTAL	1564	100.0%	2830	100.0%

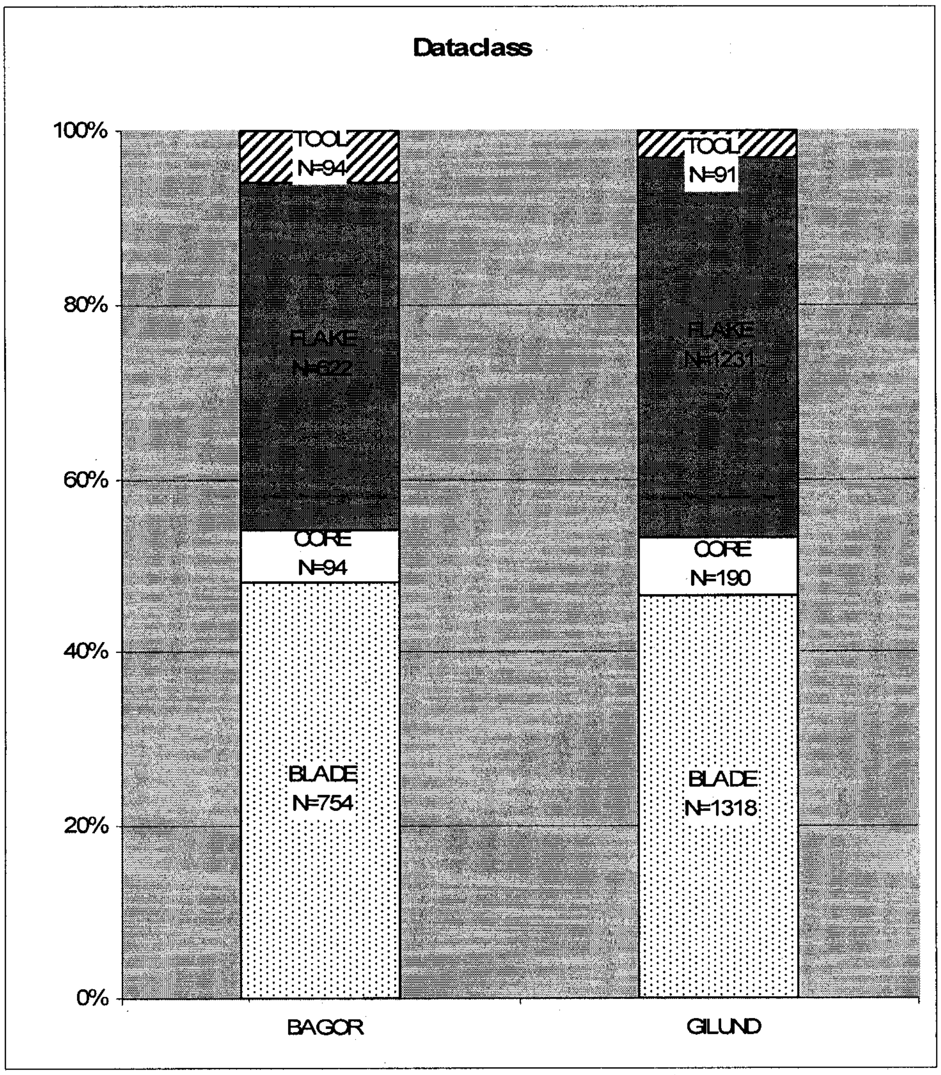

Figure 6.11 Dataclass by Site

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Tools

A total of twelve tool types were identified: six non-geometric tools and six geometric tools (see Table 6.11 and Figure 6.11)[25]. Geometric tools identified included isosceles and scalene triangles, lunates, rhomboids (only present at Gilund), trapezes and trapezoids. Although Gilund has relatively fewer tools than Bagor, it has more geometric tools (48.4%, N=44), compared to Bagor (34.0%, N=32). Lunates and triangles are the most common geometric tool at both sites. Gilund has considerably more lunates than Bagor (24.2%, N=22, compared to 7.4%, N=7), although it has fewer scalene triangles (Gilund: 15.4%, N=14; Bagor: 20.2%, N=19). It is not possible to calculate the significance of the difference between the two sites since the N's are very low for some categories. The specific form of the geometric is meant to create ease in hafting; different shapes are amenable to different hafts. However, with minor modification, it is easy to turn one geometric tool into another (Neeley and Barton 1994). So the difference in geometric shape between the two sites is not likely to be very meaningful.

The distribution of non-geometric tools (points, oblique blunted points, scrapers, burins, microburins) differs greatly between Gilund and Bagor and is significantly different (Chi-square = 36.488, df=4, p<=0.000). The widest discrepancy lies within the microburins. Microburins are the remaining waste product left after the production of geometric tools from blades. While the microburins constitute nearly one-third of the collection of Bagor tools (30.9%, N=29), there are very few microburins at Gilund (4.4%, N=4). Since the proportion of blades at both sites is roughly equal and Gilund has considerably more geometric tools, the low numbers of microburins is puzzling. Were

[25] For the purposes of this analysis microburins have been included in the "tool" category.

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these tools made offsite? Was there a separate manufacturing area in an unexcavated location on Gilund mound? Alternatively, did the inhabitants of Gilund utilize a separate technique for manufacturing geometric tools that did not include the use of microburins? It is not possible to choose between these hypotheses at this point.

The second largest difference between these two collections lies within the burins. There are more burins at Gilund (31.9%, N=29; Bagor: 10.6%, N=10), where they make up just under one-third of the collection. The reason for this difference is not clear. However, possible explanations will be explored in the core analysis section.

Finally, no transverse arrowheads or oblique blunt points were found at Gilund. Since the number of transverse arrowheads found at Bagor were very low, their absence at Gilund is not startling. However, the lack of oblique blunt points at Gilund is striking given that they comprise 9.6% (N=9) at Bagor. If oblique blunt points are used for one specific task, such as hunting, then perhaps this task was not conducted at Gilund, or it was conducted with the aide of a different implement. Alternatively, these items may have been discarded off-site, especially if they were mainly used for hunting.

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Table 6.11 Distribution of Tool Types for Each Site

	Bagor		Gilund	
	N	%	N	%
Microburin	29	30.9%	4	4.4%
Burin	10	10.6%	29	31.9%
Transverse arrowhead	2	2.1%	0	0.0%
Oblique blunt point	9	9.6%	0	0.0%
Point	5	5.3%	7	7.7%
Scraper	7	7.0%	7	8.0%
Non-geometrics subtotal	62	66.0%	47	52.0%
Isosceles triangle	3	3.2%	4	4.4%
Lunate	7	7.4%	22	24.2%
Rhomboid	0	0.0%	1	1.1%
Scalene triangle	19	20.2%	14	15.4%
Trapeze	1	1.1%	2	2.2%
Trapezoid	2	2.1%	1	1.1%
Geometrics subtotal	32	34.0%	44	48.4%
TOTAL	94		91	

Backing and Truncations

Both blades and flakes were backed at Gilund and Bagor. Among blades, there is no significant difference between the two sites for the proportions of blades that are non-backed, backed on one edge, or backed on two edges (Chi square = 1.643, df=2, p=0.440). The majority of backed pieces from both sites were backed on only one-edge (Gilund: 92.9%, N=262, Bagor: 95.6%, N=153). Backing a piece on one edge allows it to be hafted with ease. When comparing non-backed to backed blades, there is no significant difference between the two sites (Chi square =0.623, df=1, p=0.430). However, a small number of blades that were backed on both edges, or double-backed pieces, were also found at both sites (Gilund: 7.1%, N=20, Bagor: 4.4%, N=7). Some double-backed blades are considered to be drills or drill-bits in other contemporaneous sites in South Asia. At the site of Chanhu-Daro, for example, high numbers of drills and

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drill-bits were collected in association with a workshop where bead-production occurred (Kenoyer and Vidale 1993). However, since this project follows the typology set-out by Misra for Bagor (1973), double-backed blades and flakes remain in the blade and flake dataclass, and not in the tool dataclass. When comparing blades that are backed on one edge versus two edges, the difference is not statistically significant (Chi square =1.33, df=1, p=0.249). Thus, Gilund does not appear to engage in more drilling activity than Bagor.

The higher percentage of backed flakes at Gilund (N=18, 6.4%) compared to Bagor (N=2, 1.3%) is interesting and may indicate that flakes were hafted and used for tasks similar to blades. No flakes from Bagor were double-backed. When comparing non-backed flakes to those backed on one edge, the difference was found to be significant (Chi square= 5.042, df=1, p=0.025).

Table 6.12 Blade and Flake Backing

		Bagor		Gilund	
		N	%	N	%
One-edge	Blades	151	94.4%	244	86.5%
	Flakes	2	1.3%	18	6.4%
	One-edge total	153	95.6%	262	92.9%
Two-edges	Blades	7	4.4%	19	6.7%
	Flakes	0	0.0%	1	0.4%
	Two-edges total	7	4.4%	20	7.1%
TOTAL		160	100.0%	282	100.0%

The backing on most backed blades ran the full extent of the blade. However, for both sites a small portion of the collection was backed on only the proximal, medial, or distal portions. In addition, there are a few examples of blades where the proximal backing faded into retouch on the distal end. These anomalies may relate to the specific haft for which the blade was being prepared. The proportions of backing locations are

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quite similar for both sites. In fact, when comparing blades that were fully backed (full and proximal-to-retouch categories) and partially backed (proximal, medial, and distal categories), there is no significant difference (Chi square = 1.607, df=1, p=0.1954). This indicates that Gilund and Bagor had similar hafting methods and strategies.

Table 6.13 Location of Backing

	Bagor		Gilund	
	N	%	N	%
Full	147	93.0%	235	89.4%
Proximal	4	2.5%	7	2.7%
Medial	1	0.6%	1	0.4%
Distal	4	2.5%	16	6.1%
Proximal to distal retouch	2	1.3%	4	1.5%
TOTAL	158	100.0%	263	100.0%

Obverse backing is the most common backing encountered at both sites (Bagor: 78.8%, N=125, Gilund: 83.2%, N=219). The second most common technique at Bagor was a combination of inverse and obverse backing (11.3%, N=17), while at Gilund vertical backing was the second most common (10.2%, N=42). Vertical backing is a burin technique where a blow is struck on the edge of the platform to remove a sliver of material along one edge of the blade, thus blunting the blade (Cleland 1977:187-8). The effect is a blunted edge with the same thickness of a traditionally-backed blade. Backing type is not usually recorded for South Asian collections, but it offers valuable information on hafting strategies. There does not appear to be a significant difference between the four backing strategies employed at Gilund and Bagor for blades backed on one edge (Chi-square = 6.121, df=3, P<=0.106), which indicates that the inhabitants of these two sites were probably hafting blades in similar ways.

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Table 6.14 Type of Backing (blades backed on one-edge only)

	Bagor		Gilund	
	N	%	N	%
Inverse	1	0.7%	4	1.6%
Obverse	119	78.8%	203	83.2%
Inverse-obverse	17	11.3%	12	4.9%
Vertical	14	9.3%	25	10.2%
TOTAL	151	100.0%	244	100.0%

Truncations

The presence or absence of truncations was recorded for all complete blades. Four types of truncations were noted: angle, convex, notch (concave), or straight. Four truncations that did not fit these categories were recorded as "other." Truncations were identified on both backed and non-backed blades. More Bagor blades (13.0% of all blades, N=98) than Gilund blades (7.5% of all blades, N=99) were truncated; this is a significant difference (Chi square = 16.7777, df=1, $p<=0.001$).

The purpose of truncations in this region is unclear. For both sites, angle truncations were by far the most common technique, with straight truncations the second most common. At both sites truncations were more commonly identified on backed blades than on non-backed (there is no significant difference between the sites, Chi square =0.8331, df=1, $p<=1$). Both sites had small numbers of double-backed blades with truncations.

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Table 6.15 Summary of Truncations

	Bagor		Gilund	
	N	%	N	%
Non-truncated Total	656	87.0%	1219	92.5%
Truncated Total	98	13.0%	99	7.5%
TOTAL	754	100.0%	1318	100.0%

Table 6.16 Truncations on backed and non-backed blades

		Bagor		Gilund	
Backing	Truncation	N	%	N	%
None	Angle	27	27.6%	12	12.1%
	Convex	2	2.0%	1	1.0%
	Notch	5	5.1%	11	11.1%
	Other	0	0.0%	2	2.0%
	Straight	12	12.2%	12	12.1%
None total		46	46.9%	38	38.3%
One-edge	Angle	29	29.6%	44	44.4%
	Convex	0	0%	1	1.0%
	Notch	7	7.1%	2	2.0%
	Other	0	0%	2	2.0%
	Straight	13	13.3%	4	4.0%
One-edge Total		49	50.0%	53	53.4%
Two-edges	Angle	1	1.0%	6	6.1%
	Notch	2	2.0%	2	2.0%
Two-edges Total		3	3.0%	8	8.1%
TOTAL		98		99	

Platform Preparation

The method of platform preparation was recorded for all complete and proximal blades and flakes (see table 6.17 and table 6.18). Platform preparation as represented on flakes and blades provides information about core preparation and flake and blade removal. Platforms must be prepared in specific ways in order to use pressure debitage (Pelegrin 1994). Raw material also influences platform preparation. Seven categories were noted:

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- Unprepared
- Punctiform
- Flat—a single flake had been removed to create the platform
- Dihedral
- Multifaceted
- Flaked—the platform edge had been prepared through the removal of small flakes (see Cleland 1977)
- None—the platform was either missing or so thin that it appeared non-existent.

For both sites, the majority of blade platforms were flat, or prepared by the removal of a single flake (Bagor: 63.3%, N=349; Gilund: 46.3%, N=487), however there is a significant difference in the distribution of platform preparation methods between the two sites (Chi-square=60.6769, df=6, p<=0.001). Among blades, both Gilund and Bagor have similar proportions of punctiform, dihedral, multifaceted and missing platforms. The main differences lie in the percentage of flat, flaked, and unprepared platforms, with Gilund having more flaked and unprepared blade platforms. The greater percentage of unprepared platforms at Gilund may be attributed to the increased use of quartz which in this region occurs naturally with flat areas that can serve as a functional platform without further preparation.

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Table 6.17 Blade Platform Preparation

	Bagor		Gilund	
	N	%	N	%
Dihedral	53	9.6%	91	8.7%
Flaked	34	6.2%	122	11.6%
Flat	349	63.3%	487	46.3%
None	14	2.5%	33	3.1%
Multifaceted	42	7.6%	96	9.1%
Punctiform	20	3.6%	40	3.8%
Unprepared	39	7.1%	183	17.4%
TOTAL	551	100.0%	1052	100.0%

More differences are noted between the two sites when comparing the flake platforms (see Table 6.18 Flake Platform Preparation); these differences are significant (Chi-square = 50.7273, df=6, p<=0.001). Bagor has fewer flaked, multifaceted, and punctiform platforms, while Gilund has fewer flakes with no platforms. While Bagor flakes mostly have flat platforms (40.9%, N=253), the majority of Gilund flakes are unprepared (31.9%, N=392), with flat platforms comprising 29.6% of the collection (N=363). Both collections have 9.9% dihedral platforms on flakes.

The greater number of flakes with unprepared platforms as compared to blades is not surprising, since most blades are removed from formal cores, while many flakes are either produced from an informal core or are used to prepare or rejuvenate formal blade cores. Setting up a proper platform for flakes may be less important than doing so for blades, since the preservation of the core shape is much more important for blade production. In fact, the flakes may be the product of blade core preparation.

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Table 6.18 Flake Platform Preparation

	Bagor		Gilund	
	N	%	N	%
Dihedral	61	9.9%	121	9.9%
Flaked	27	4.4%	129	10.5%
Flat	253	40.9%	363	29.6%
None	38	6.1%	50	4.1%
Multifaceted	44	7.1%	122	9.9%
Punctiform	9	1.5%	50	4.1%
Unprepared	187	30.2%	392	31.9%
TOTAL	619	100.0%	1227	100.0%

Measurements

Length

In general, the Bagor lithics are smaller than those from Gilund. Chalcedony lithics tend to be smaller than chert lithics, which tend to be smaller than quartz lithics at both sites, The exceptions are chalcedony flakes and tools at Gilund, which are slightly larger than their chert counterparts. However, there are very few chalcedony flakes and tools at Gilund, so it is difficult to determine to what extent these artifacts are representative.

There seems to be great variation in the length of lithics made from "other" raw materials at both sites (see standard deviations in Table 6.19 Length by dataclass and raw material). The category of "other" raw materials includes those materials that were found in very small quantities: quartzite, basalt, and garnet. In general the quartzite lithics are quite large while the garnet lithics are very small; the length of basalt lithics falls in between. The length of chert blades at Gilund also varies greatly (SD=26.72). The reason for this anomaly is unclear. The standard deviation for quartz lithics of all types is

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larger than those for chert and chalcedony, which is to be expected. The quality of quartz material varies greatly and this affects the way that the material is knapped, as well as length.

Average blade length is smaller than average blade core length at both sites, which is a surprising finding. Usually core length is shorter than blade length on average, since cores are discarded after multiple blade removals and several rounds of rejuvenation, all of which serve to shorten the core. It is possible that Gilund and Bagor cores were not rejuvenated by the removal of the platform, as is common with bullet cores. Because the cores are worked from front to back, instead of all-around, and because the bulb scars are so insignificant, the initial platform may have been sufficient for continual blade production. Alternatively, cores may have been discarded when the platform was worn, instead of being rejuvenated. In some cores with multiple platforms, core rejuvenation occurred by turning the core instead of creating a core tablet, so the core is not necessarily shortened.

The average length of complete blades at Bagor is significantly shorter than those from Gilund ($t=-10.86$, $df=538$, $p=0.000$). This is true for complete quartz blades ($t=-2.87$, $df=516$, $p=0.004$), complete chalcedony blades ($t=-4.28$, $df=14$, $p=0.001$), and complete chert blades ($t=-4.36$, $df=53$, $p=0.000$). However, when examining complete flakes, there is no significant difference for quartz ($t=-1.74$, $df=238$, $p=0.084$), or chalcedony ($t=-1.99$, $df=37$, $p=0.054$). There is a significant difference in length for chert ($t=-3.21$, $df=325$, $p=0.001$).

The length of complete blade cores and complete flake cores were compared separately. Chert and quartz blade cores were both significantly smaller at Bagor (chert:

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t=-2.53, df=28, p=0.017; quartz: t=-6.09, df=150, p=0.000). As there were only two chalcedony blade cores it was not possible to test the significance of the difference in this material. Among flake cores, it was only possible to examine quartz cores since there were so few cores of the other materials. For quartz flake cores, Bagor was significantly smaller than Gilund (t=-2.60, df=81, p=0.011).

Table 6.19 Length by Dataclass and Raw Material (mm)

		Bagor		Gilund	
		Mean	StD	Mean	StD
Blade	Chalcedony	8.02	6.17	11.93	11.48
	Chert	8.85	5.77	14.08	26.72
	Other	12.68	10.48	21.09	16.34
	Quartz	8.75	8.04	10.96	10.90
BLADE Total		8.78	6.91	11.54	13.82
Core	Chalcedony	16.77	N/A	13.92	N/A
	Chert	17.57	3.13	21.24	2.69
	Other	25.52	N/A	N/A	N/A
	Quartz	18.67	7.77	27.33	11.49
CORE Total		18.42	0.00	27.10	12.00
Flake	Chalcedony	8.70	6.64	14.69	6.70
	Chert	11.78	7.44	13.84	7.91
	Other	13.51	9.33	25.15	16.85
	Quartz	12.15	9.89	14.93	10.59
FLAKE Total		11.74	9.07	15.16	10.67
Tool	Chalcedony	11.64	1.64	69.03	N/A
	Chert	11.74	5.37	13.87	5.72
	Other	N/A	N/A	8.38	N/A
	Quartz	13.12	5.56	16.59	5.80
TOOL Total		12.50	0.00	16.90	12.70

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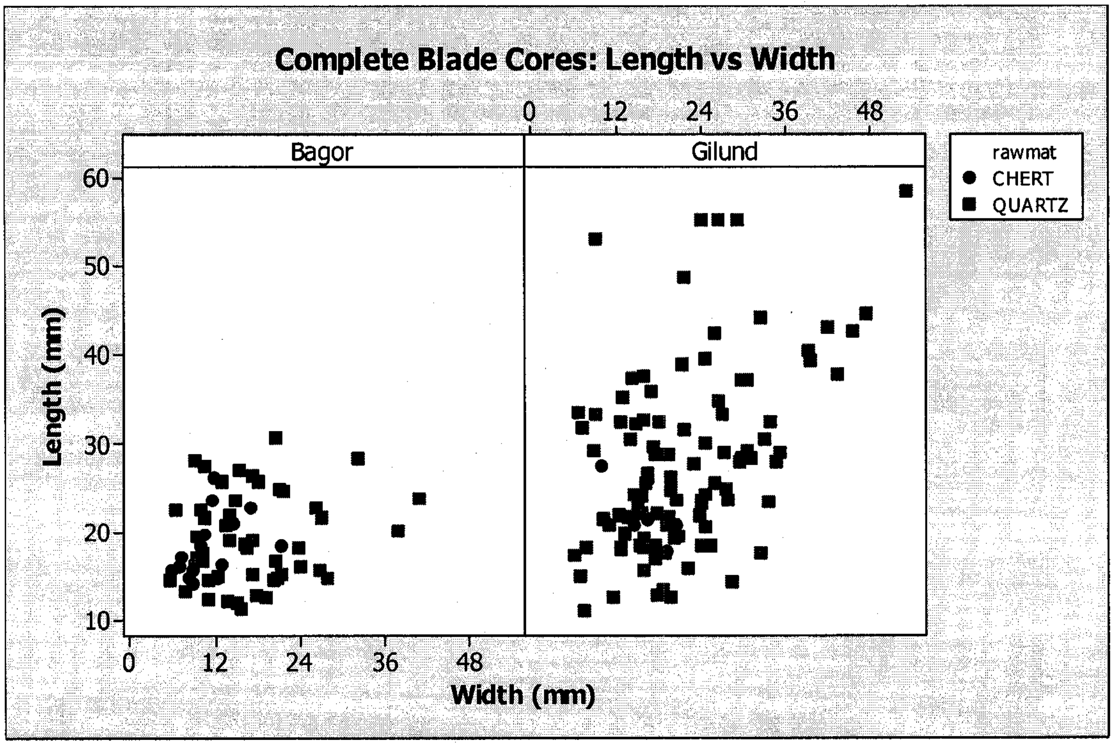

Figure 6.12 Scatterplot of Complete Blade Cores: Length versus Width

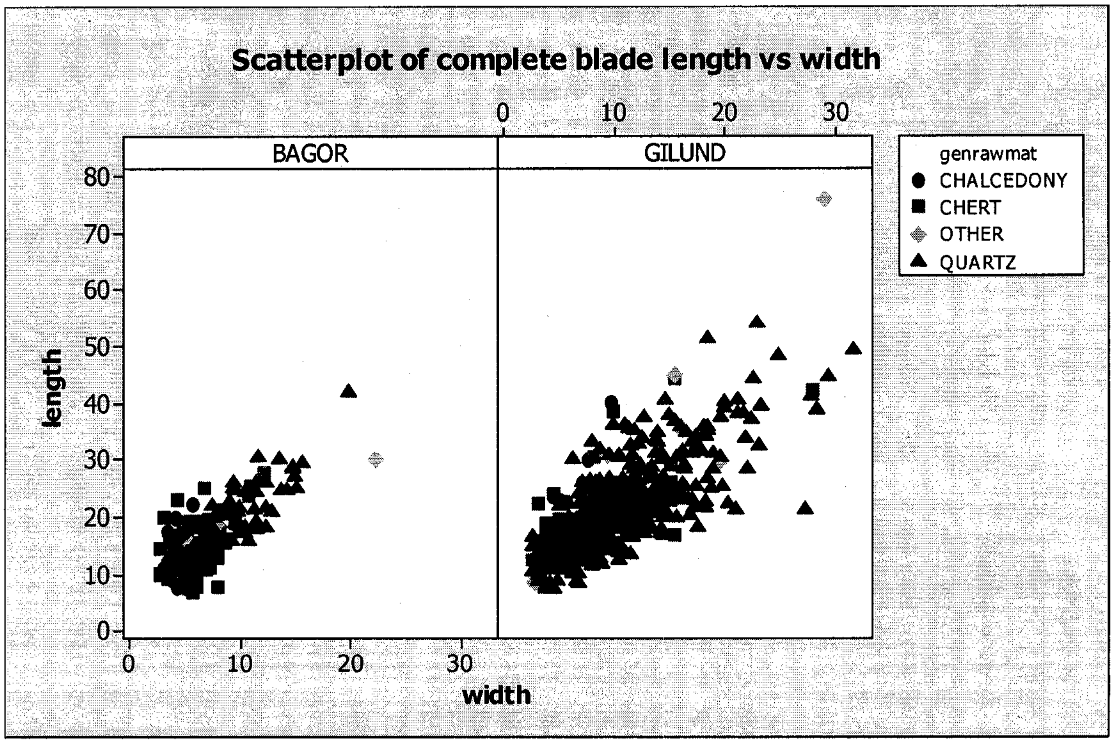

Figure 6.13 Scatterplot of Complete Blades: Length versus Width

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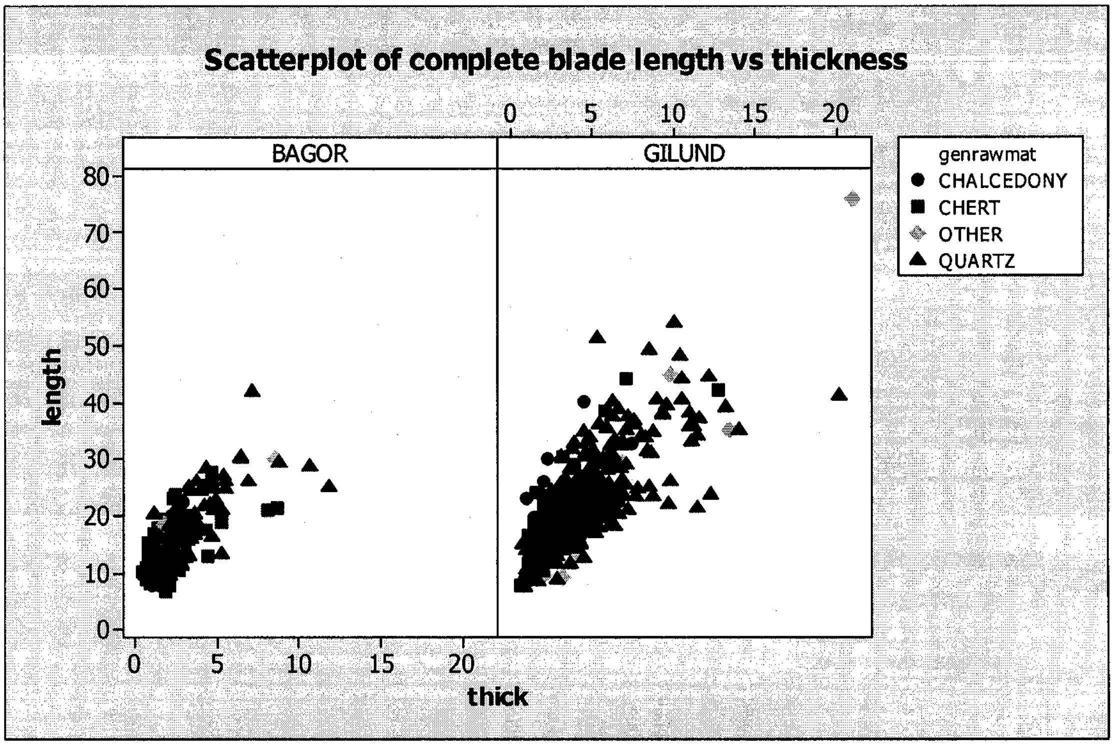

Figure 6.14 Scatterplot of Complete Blades: Length versus Thickness

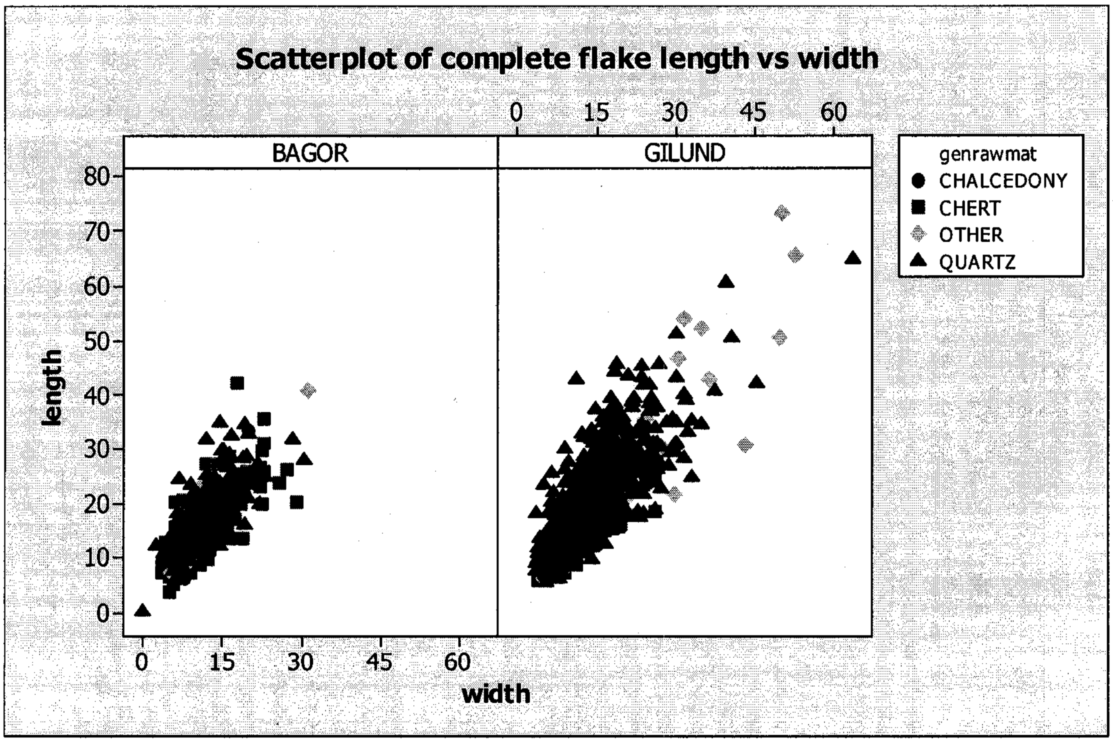

Figure 6.15 Scatterplot of Complete Flakes: Length versus Width

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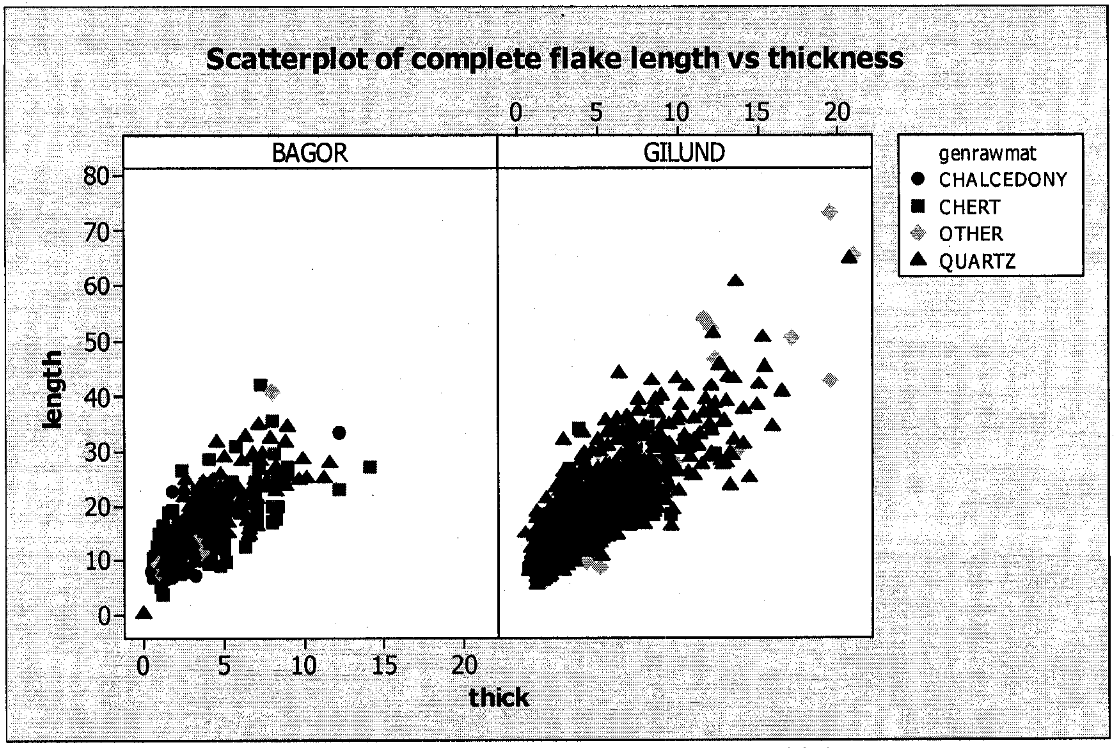

Figure 6.16 Scatterplot of Complete Flakes: Length versus Thickness

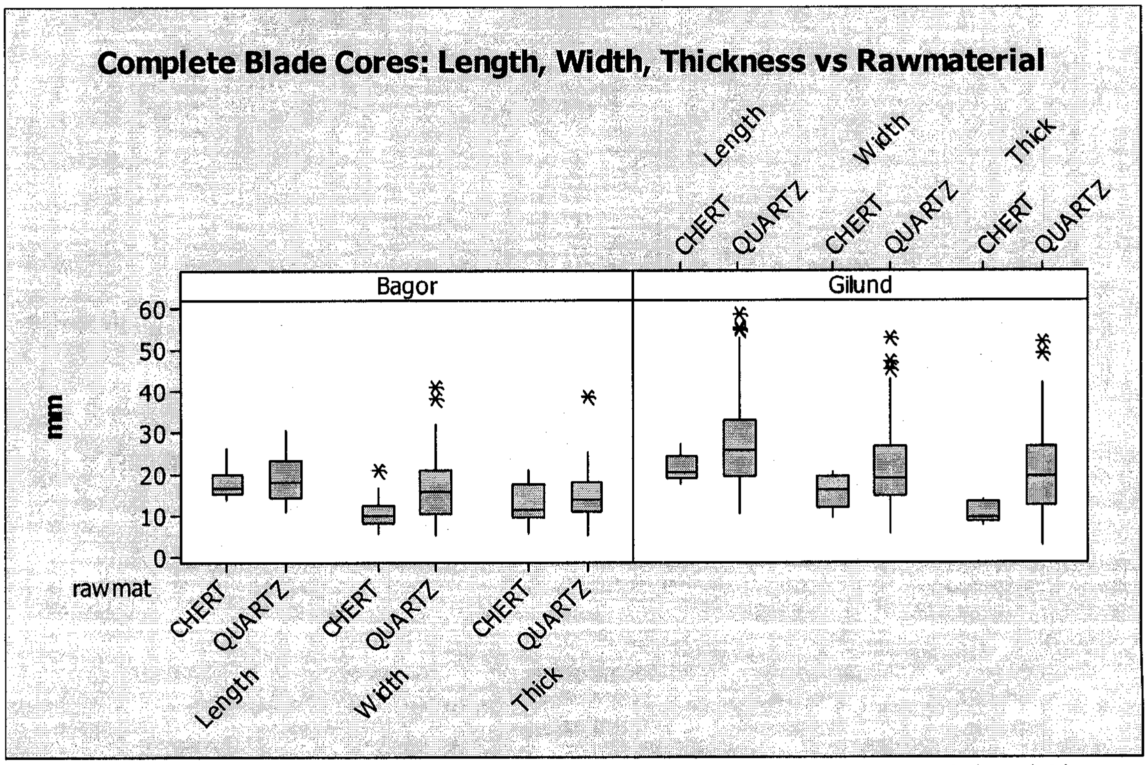

Figure 6.17 Boxplot of Core Length, Width and Thickness by Raw Material and Site

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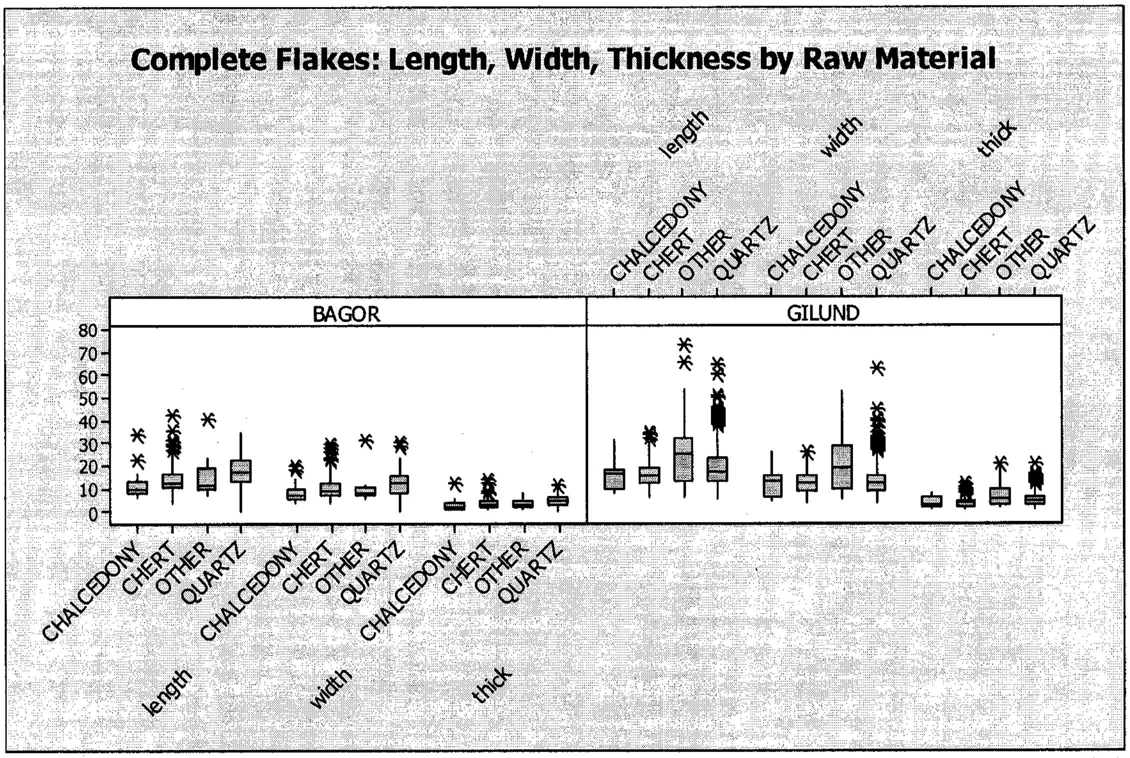

Figure 6.18 Boxplot of Complete Flake Length, Width and Thickness by Raw Material and Site

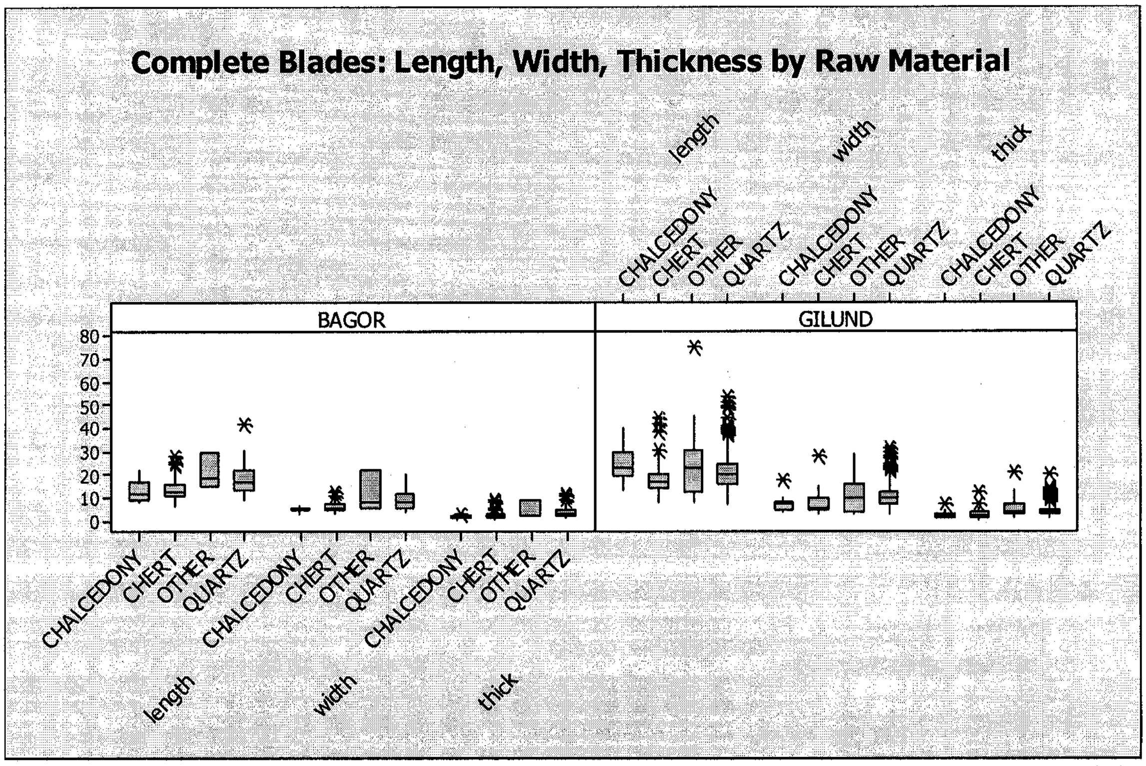

Figure 6.19 Boxplot of Complete Blade Length, Width and Thickness by Raw Material and Site

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Width

Like length, the width of most Bagor lithic types is less than their Gilund counterparts. The exceptions to this rule are chalcedony blades and chert tools, which are wider at Gilund. "Other" raw material is the widest, most likely because the quartzite is difficult to knap. Quartz follows "other" as the second widest. This is followed by chert and chalcedony.

As with length, the standard deviations of width are largest for the "other" raw material category, presumably for the same reasons: high variation in material quality. The standard deviations are also high for quartz cores (Gilund: 11.60, Bagor: 9.09) and flakes (Gilund: 6.85, Bagor: 6.96). There is a great deal of variation of width within chert blades at Gilund, as well.

For flakes and blades, only complete unbacked pieces were compared since backing changes the width of the piece. There is a significant difference for all three materials between Gilund and Bagor unbacked blades (Quartz: t=-2.94, df=91, p=0.004; Chert: t=-2.43, df=42, p=0.019; Chalcedony: t=-2.54, df=8, p=0.034). The same is true for complete unbacked flakes (Quartz: t=-2.36, df=229, p=0.019; Chert: t=-3.06, df=325, p=0.002; Chalcedony: t=-2.76, df=36, p=0.009).

Complete blade cores of quartz were significantly different (t=-2.90, df=121, p=0.004). However, complete blade cores of chert were not (t=-1.16, df=3, p=0.330). Again, there were too few chalcedony cores to test the difference. Among flake cores, only quartz had enough samples to test for significance. It was found that the difference

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in width of flake cores between the two sites was not significant (t=-2.04, df=15, p=0.059).

Table 6.20 Width by Dataclass and Raw Material (mm)

		Bagor		Gilund	
		Mean	StD	Mean	StD
Blade	Chalcedony	4.27	2.91	4.21	4.06
	Chert	4.62	2.82	7.16	18.78
	Other	6.14	7.62	11.07	8.10
	Quartz	7.28	3.55	9.11	5.10
BLADE Total		5.75	3.48	8.81	8.00
Core	Chalcedony	7.25	N/A	12.03	N/A
	Chert	11.96	3.67	15.73	4.87
	Other	12.22	N/A	N/A	N/A
	Quartz	16.96	9.09	23.35	11.60
CORE Total		15.42	0.00	23.09	16.08
Flake	Chalcedony	6.44	4.51	11.63	5.75
	Chert	9.16	6.25	10.86	6.28
	Other	10.07	6.67	19.80	13.45
	Quartz	8.11	6.96	12.08	6.85
FLAKE Total		8.62	7.25	12.21	7.19
Tool	Chalcedony	5.15	1.30	30.23	N/A
	Chert	6.80	5.00	6.36	2.88
	Other	N/A	N/A	5.11	N/A
	Quartz	6.77	4.04	8.62	4.73
TOOL Total		6.70	0.00	8.67	6.74

Thickness

All Bagor types are thinner than Gilund on average, although not significantly so. Chalcedony complete blades are thinner than chalcedony complete flakes at both sites. This is true for chert blades and flakes at Bagor, as well. However, Gilund chert flakes are thinner than blades. Thickness is much more consistent than length and width for all artifact classes.

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Chert blades at Gilund also demonstrate great variability in thickness, as in width and length. There is no significant difference between complete blades of Gilund and Bagor for any of the three raw materials (quartz: t=-1.84, df=516, p=0.067; chert: t=-2.65, df=57, p=0.10; chalcedony: t=-1.95, df=10, p=0.079). This is also true of all three materials for complete flakes (quartz: t=-1.65, df=237, p=0.101; chert: t=-1.69, df=325, p=0.092; chalcedony: t=-1.46, df=37, p=0.153).

Quartz cores have the largest standard deviations at both sites, indicating some variation within this class and material. Chalcedony cores are substantially thinner than cores of other materials, which may indicate that they were either worked differently, or more intensively. Chert and quartz cores at Bagor have very close average widths which may indicate that they were worked similarly. Since the quartz material at Bagor was very fine, this is possible. There is no significant difference between Gilund and Bagor for either flake or blade cores (chert blade cores: t=0.87, df=28, p=0.394; quartz flake cores: t=-1.66, df=81, p=0.101).

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Table 6.21 Thickness by Dataclass and Raw Material (in mm).

		Bagor		Gilund	
		Mean	StD	Mean	StD
Blade	Chalcedony	1.05	0.84	1.39	1.57
	Chert	1.37	1.18	3.38	18.19
	Other	2.28	2.91	5.09	4.83
	Quartz	2.72	1.62	3.32	2.25
BLADE Total		1.93	1.55	3.31	6.47
Core	Chalcedony	4.42	N/A	5.72	N/A
	Chert	13.25	5.79	11.13	2.71
	Other	16.34	N/A	N/A	N/A
	Quartz	13.16	8.03	18.73	11.05
CORE Total		13.13	0.00	18.46	11.28
Flake	Chalcedony	1.80	2.08	3.48	2.36
	Chert	2.67	2.36	3.10	2.41
	Other	3.21	1.93	6.93	5.45
	Quartz	2.94	2.81	4.18	3.04
FLAKE Total		2.72	4.63	4.16	3.46
Tool	Chalcedony	1.88	0.90	17.17	N/A
	Chert	2.37	2.08	2.52	1.18
	Other	N/A	N/A	1.70	N/A
	Quartz	3.03	1.88	3.47	1.73
TOOL Total		2.71	0.00	3.54	3.07

Weight

Chalcedony appears to produce the lightest artifacts while “other” and quartz are the heaviest. Blades and flakes of “other” raw materials are the heaviest at both sites, while quartz produces the heaviest cores at both sites. Among tools, chert is heaviest at Bagor and quartz is heaviest at Gilund. Gilund chalcedony tools are unusually large. Standard deviations are high for quartz cores at both sites and for “other” flakes.

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Table 6.22 Weight by Dataclass and Raw Material (in grams)

		Bagor		Gilund	
		Mean	StD	Mean	StD
Blade	Chalcedony	0.14	0.13	0.40	0.89
	Chert	0.19	0.32	0.51	1.77
	Other	1.43	3.16	4.93	10.81
	Quartz	0.55	0.91	1.20	2.18
BLADE Total		0.35	0.73	1.18	2.65
Core	Chalcedony	0.60	N/A	1.40	N/A
	Chert	4.36	3.93	5.60	1.87
	Other	6.00	N/A	N/A	N/A
	Quartz	8.59	11.77	23.66	29.05
CORE Total		7.31	7.58	23.06	24.23
Flake	Chalcedony	0.44	1.27	1.13	1.43
	Chert	0.95	2.23	1.32	2.43
	Other	1.75	4.43	10.72	22.57
	Quartz	1.33	1.76	2.46	5.87
FLAKE Total		1.07	2.10	2.61	7.01
Tool	Chalcedony	0.14	0.05	48.10	N/A
	Chert	0.92	2.76	0.22	0.13
	Other	N/A	N/A	0.10	N/A
	Quartz	0.65	1.27	0.93	1.52
TOOL Total		0.73	1.95	1.39	5.15

Core Attribute Analysis[26]

Core analysis was undertaken in order to identify the range of preparation and blade removal techniques utilized at Gilund and Bagor. Attributes recorded include core type (i.e. blade or flake), raw material, shape, platform, body preparation, and initiation. As mentioned in Chapter 3, core technology in South Asia has not been sufficiently studied, although several scholars indicate that a change in core technology may have occurred at the beginning of the Chalcolithic with the introduction of crested-ridge core preparation. (Sankalia 1964a; Subbarao 1955). Others have noted in passing that a

[26] All core data comes from a subset of the complete data set. While there are 190 cores in the complete data set for Gilund, only 162 are included in this set. Similarly, for Bagor, there are 94 cores in the complete dataset, but only 89 cores are included in this analysis. A smaller set of cores was included in this analysis because several artifacts could not be located at the time of core analysis.

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variety of blade core types may have existed throughout the Holocene and that these types correlate with region or subsistence method. For example, Ajithprasad (2002b) argues that a unique core type can be found throughout Gujarat from sites dated to the fifth millennium BC and later. Others argue that hunter-gatherers may have used a different core preparation technique from their agricultural neighbors. This section presents a series of analyses undertaken on the cores from Gilund and Bagor in order to evaluate the following propositions:

- Crested ridges emerged in the Chalcolithic and became widespread; crested ridges are the *fossil directeur* of the Chalcolithic time period; lack of crested ridges indicates that a site was occupied prior to the Chalcolithic.
- Core technology is regionally bounded; each region utilizes a specific core preparation technique.
- Hunter-gatherers, pastoralists, and agriculturalists utilize separate core preparation techniques in South Asia

Core Type

Cores were categorized as either blade or flake. Cores with both blade and flake removals were categorized as blade cores since flakes may have been removed to shape the core. Both sites had a preponderance of blade cores, as compared to flake cores (see Table 6.23 Core types by site). This supports the finding of more blades than cores at both sites and suggests that overall, both sites favored formal lithic technology over informal. However, Gilund had significantly fewer blade cores (compared to flake cores) than Bagor (66.0% versus 86.5%) (Chi-square=12.297; DF=1; P<0.01), which parallels a similar finding of the difference between Gilund and Bagor regarding flakes and blades.

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Table 6.23 Core Types by Site

	Bagor		Gilund	
	N	%	N	%
Blade	77	86.5%	107	66.0%
Flake	12	13.5%	55	34.0%
TOTAL	89	100.0%	162	100.0%

Raw Material

The majority of cores at both sites were made of quartz (see Table 6.24 Raw Material Distribution of Cores by Type and Site). Quartz is plentiful in the areas near both sites, so it is not surprising that the majority of cores were made of this local material. Overall, there are few chalcedony cores, and none from Gilund were included in the study. When comparing non-quartz to quartz cores, Gilund had significantly more quartz cores than Bagor (Chi-square = 38.3476, df=1, p<=0.001). The lower mobility levels of the inhabitants of Gilund may help to explain this significant difference. Raw material is discussed in further detail in a section below that reviews all artifacts.

Table 6.24 Core Types by Raw Material and Site

		Bagor		Gilund	
		N	%	N	%
Blade	Chalcedony	1	1.3%	0	0.0%
	Chert	26	33.8%	5	4.7%
	Quartz	50	64.9%	102	95.3%
BLADE TOTAL		77	100.0%	107	100.0%
Flake	Quartz	12	100.0%	55	100.0%
FLAKE TOTAL		12	100.0%	55	100.0%
TOTAL		89		162	

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Blade core shape

Although core shape is frequently noted in site reports, it is rarely systematically studied, particularly in South Asia. This study focused on core shape because initial examination of the material suggested that multiple core preparation and blade production techniques were in use at both sites. Shape is one of the features that can provide a great deal of information about the production techniques employed. As discussed in chapter 3, many factors influence core shape. In this study, ten categories of blade core shape were recorded: wedge (both trapezoid and triangle), block, flat, cylinder, half-cylinder, sub-cylinder, pyramid, half-pyramid, subpyramid, half-subpyramid, on-flake and amorphous. The description of each of these shapes can be found in Table 6.25 Blade core shape descriptions.

Table 6.25 Blade Core Shape Descriptions

Wedge-trapezoid	Generally wedge-shaped with a trapezoid silhouette when viewed from the side
Wedge-triangle	Generally wedge-shaped with a triangle silhouette when viewed from the side
Block	Somewhat cubical
Amorphous	Having multiple irregular protrusions
Flat	A thinner version of the block core, this core is generally thin front to back; see (Cleland 1977)
Cylinder	Cylindrical or bullet-shaped
Half-cylinder	The face and sides appear like a cylinder core, but the back is completely flat; it is like a cylinder core that has been sliced in half vertically
Subcylinder	Similar to a cylinder, but somewhat less defined; is not a perfect cylinder
Pyramid	The core is round, but comes to a point at the bottom, like a funnel
Subpyramid	Like a pyramid core, but somewhat less well defined
Half-subpyramid	Like a subpyramid when viewed from the front, but completely flat on the back side. It is as if a subpyramid core has been sliced in half vertically.
on-flake	The initial core preform is a flake

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No proper cylinder or pyramid cores were identified in the study samples from Gilund and Bagor. However, it should be noted that one very nice cylinder core of chalcedony was collected at Gilund from the surface of the mound. Cylinder cores are found in some other regions of South Asia, but not all (see Chapter 3).

Table 6.26 Blade Core Shapes by Site

	Bagor		Gilund	
	N	%	N	%
Wedge-trapezoid	27	31.8%	33	20.5%
Wedge-triangle	9	10.6%	14	8.7%
Block	23	27.1%	21	13.0%
Amorphous	10	11.8%	44	27.3%
Flat	8	9.4%	23	14.3%
Half-cylinder	1	1.2%	10	6.2%
Half-subpyramid	0	0.0%	1	0.6%
on-flake	6	7.1%	12	7.5%
Subcylinder	1	1.2%	1	0.6%
Subpyramid	0	0.0%	2	1.2%
TOTAL	85	100.0%	161	100.0%

The majority of blade cores from Bagor were wedge-shaped with a trapezoid profile (31.8%). Block cores were the second most common shape (27.1%), followed by amorphous (11.8%) then wedge-shaped with a triangle profile (10.6%). At Gilund, amorphous cores were most common (27.3%), followed by wedge-shaped cores with a trapezoid profile (20.5%), then flat (14.3%), and block (13.0%). Core shape is influenced by core preparation and blade removal, among other things. The variety of core shapes at each site demonstrates that a diversity of core preparation and blade removal techniques were utilized at both sites and that cores were discarded after various stages of use.

There is a significant difference in shape distribution between the two sites when examining the nine core shapes (Chi-square = 21.3666, df=9, $p<=0.025$). In order to determine whether this difference in shape preference was related to removal direction,

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the nine core shapes were grouped into three groups: cores where blades were removed from front to back (i.e. slicing), cores on which blades were removed by rotating, and flexible cores. Cores worked front to back, or "slice" cores include wedge-trapezoid, wedge-triangle, flat, and on-flake. Rotated cores include half-cylinder, subcylinder, half-subpyramid and subpyramid cores. Finally, flexible cores, or cores that are not rotated, but are worked in multiple ways that may or may not move from front to back, include block and amorphous cores. Both sites have a majority of cores that were worked from front to back (Bagor 58.8%, Gilund 50.9%), followed by flexible cores (Bagor 38.8%, Gilund 40.4%). Both sites have few rotated cores (Bagor 2.4%, Gilund 8.7%). This indicates that although both Gilund and Bagor used a variety of blade removal patterns, they rarely utilized a rotating system. There is no significant difference in distribution between the two sites when considering these three categories of core shape (Chi-square = 4.1201, df=2, $p<=0.20$). The blade removal strategies employed by Gilund and Bagor appear to be very similar. This challenges the proposition that hunter-gatherers and agriculturalists in South Asia utilized separate core preparation techniques.

Table 6.27 Distribution of Cores among Simplified Core Shape Categories

	Bagor		Gilund	
	N	%	N	%
Slice Cores	50	58.8%	82	50.9%
Rotate Cores	2	2.4%	14	8.7%
Flexible Cores	33	38.8%	65	40.4%
	85	100.0%	161	100.0%

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Core Platform and Body Preparation

Platform preparation for both blade cores and flake cores were recorded for each site. For both sites, most blade core platforms were prepared by removing a single flake from the top of the core. The second most common technique for both sites was to leave the platform unprepared. Some cores had been prepared by the removal of multiple flakes from the platform (Bagor: 18.1%, N=13; Gilund 12.1%, N=13). There is no significant difference of blade core platform preparation methods between Gilund and Bagor (Chi-square=2.429, DF=2, P=.297). They appear to be using similar strategies in preparing the core platforms for the initial blade removal. The method of core platform preparation echoes the findings of blade platform preparation above.

Table 6.28 Blade Core Platforms by Site (complete cores only)

	Bagor		Gilund	
	N	%	N	%
Multiple Flakes	13	18.1%	13	12.1%
None	20	27.8%	24	22.4%
Single-Flake	39	54.2%	70	65.4%
TOTAL	72	100.0%	107	100.0%

Table 6.29 Blade Core Platforms by Raw Material and Site (complete cores only)

		Bagor		Gilund	
		N	%	N	%
Chert	Multiple Flakes	9	36.0%	0	0.0%
	None	1	4.0%	2	40.0%
	Single Flake	15	60.0%	3	60.0%
CHERT Total		25	100%	100.0%	100%
Quartz	Multiple Flakes	4	8.5%	13	12.7%
	None	19	40.4%	22	21.6%
	Single Flake	24	51.1%	67	65.7%
QUARTZ Total		47	100%	100.0%	100%
TOTAL		72		107	

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At both sites, single flake platforms were the most common preparation technique for both quartz and chert. However, the two sites vary in terms of the frequency of multiple flake platforms or no preparation platforms for chert versus quartz. Gilund had no chert cores with platforms prepared through the removal of multiple flakes; 40.0% of chert cores had no platform preparation. Bagor, on the other hand, had a high number of chert cores with multiple flake platforms (36.0%), and very few chert cores with no platform preparation (4.0%). The difference in distribution of chert core platforms between the two sites appears to be significant (Chi-square =7.2, df=2, p<=0.05), however, these results are only suggestive, given the low N for Gilund. When comparing chert cores with no platform preparation and cores with any kind of platform preparation, it appears that there is no significant difference between the two sites (Fisher's exact=0.061576, df=1).

Both sites had more quartz cores with no preparation (Gilund 21.6%, Bagor 40.4%) than with multiple flake removals on the platform (Gilund 12.7%, Bagor 8.5%). However, there appears to be a significant difference between Gilund and Bagor among prepared or non-prepared platforms of quartz cores (Fisher's exact=0.009695, df=1). While lack of preparation is expected for quartz cores (due to the natural ridges and angles that occur on quartz), it is surprising to see for chert cores. It appears that Gilund knappers were less fastidious about preparing their cores before knapping, regardless of raw material.

Unlike blade cores, flake cores had a majority of unprepared platforms (Bagor: 72.7%, N=8; Gilund 57.4%, N=31), although many had a single flake removed to prepare the platform (Bagor: 18.2%, N=2; Gilund 37.0%, N=20). Although the total N of Bagor

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flake cores is too low to perform a Chi-square test, the distribution of platforms is striking. Flakes and flake cores, then, at both sites were made very expediently.

Table 6.30 Flake Core Platforms by Site (complete cores only)

	Bagor		Gilund	
	N	%	N	%
Multiple Flakes	1	9.1%	3	5.6%
None	8	72.7%	31	57.4%
Single Flake	2	18.2%	20	37.0%
TOTAL	11	100.0%	54	100.0%

Blade Core Platform Edge Preparation

In order to further detail the methods used to prepare blade cores, preparation of the platform edge also was recorded. Overall, few cores evidenced signs of edge preparation. No significant difference was recorded for the two sites (Chi-square=0.3293; p<=1). It appears that either platform edge was rarely prepared or that platform edge may have been prepared just prior to blade removal and limited to precisely the area where the blade was removed, which means most discarded cores would evidence no sign of platform edge preparation.

Table 6.31 Blade Core Platform Edge Preparation

	Bagor		Gilund	
	N	%	N	%
None	65	89.0%	98	92.6%
Small Flakes	8	11.0%	9	8.4%
TOTAL	73	100.0%	107	100.0%

Core Body Preparation

Along with platform preparation, preparation of the core body was recorded. As mentioned above, no cores with crested ridges were identified in the samples from either

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site.[27] This challenges one of the propositions about lithics in South Asia: that the presence of a crested ridge dates a site to the Chalcolithic and the absence of crested ridges indicates that the site was occupied at an earlier date. At Gilund and Bagor alternative techniques were used to prepare the blade core bodies.

The vast majority of blade cores from both sites show no evidence of body preparation prior to blade removal (Bagor, 72.2%, N=52; Gilund: 80.4%, N=86%). It should be noted that some blade cores had blade removals on all sides, so any previous core preparation would not be evident. However, most cores were only worked on one face or one face and one side (Bagor 67%, N=49; Gilund 58%, N=62; complete blade cores only), which left the remaining areas visible. There is no significant difference in the distribution between Gilund and Bagor in terms of prepared or unprepared core bodies (Chi-square = 1.6195, df=1, p<=1) or in the distribution of all core body preparation techniques (Chi-square = 1.9407, df=3, p<=1). In addition, at both sites 56% of cores (Bagor: N=40, Gilund: N=60) had three or fewer removals (counts included blade bulb scars only).

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[27] It should be noted that cores with more than one platform occasionally have blade scars that intersect. These intersections look like crested ridges, and can potentially be utilized as crested ridges. However, these ridges should be considered separately from those that are formed by the removal of small flakes as a preparation technique to set up the first blade removal on a core. Some cores from Gilund and Bagor had the intersecting, or secondary, ridges, but none of these ridges were at an appropriate angle to a platform to actually be used as a guiding ridge. While a new platform could be removed to enable the use of the ridge, this technique is considered here to be a rejuvenation technique, not an initiation technique. Inizan and Lechevallier, in their 1995 study of the Bagor collections note that, "The large number of crested bladelets and the presence of crests on some cores indicate a systematic preparation method" (Inizan and Lechevallier 1995:18). Unfortunately, they do not include crested ridge bladelets in their table of assemblage distribution, so it is not possible to tell how many crested ridge bladelets they identified. It is possible that the cores that they were referring to had rejuvenation crested ridges instead of initiation crested ridges. In my study sample, no initiation crested ridges on cores, blades, or flakes were noted from either site.

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Table 6.32 Blade Core Body Preparation (complete cores only)

	Bagor		Gilund	
	N	%	N	%
Biface	3	4.2%	3	2.8%
None	52	72.2%	86	80.4%
Single-Flake	14	19.4%	16	15.0%
Uniface	3	4.2%	2	1.9%
TOTAL	72	100.0%	107	100.0%

It is interesting that so few cores show evidence of body preparation. In all, 25% of Bagor blade cores (N=13) and 21% of Gilund blade cores (N=18) show no evidence of either body or platform preparation.

Initiation

In an effort to understand how blade cores were prepared and worked at each site, each core was examined for evidence of the technique employed to remove the first blade. In blade cores there are typically three types of initial blades: crested ridges, burin-like, and natural ridge (see Chapter 3 for discussion). It was not possible to determine how the first blade was removed for most cores in the study sample, since multiple blades had been removed and the initial blade scar was no longer distinguishable. Continual working of the core removes all traces of the initial blade. For the most part, it was not possible to determine how the first blade was initiated on cores with more than three blade scars, which was just under half of the collection for both sites. However, for 25% of the Bagor collection (N=18) and 31% of the Gilund collection (N=33), it was possible to identify how the first blade was removed. In my analysis, no core exhibited signs that a crested ridge had been created to aid the removal

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of the initial blade. A few cores showed signs where the blade ridge had been created by intersecting blade removal faces.

Table 6.33 Blade Core Initiation Technique (complete cores only)

	Bagor		Gilund	
	N	%	N	%
Crested ridge	0	0.0%	0	0.0%
Burin	17	23.6%	28	26.2%
Indeterminate	54	75.0%	74	69.2%
Other	1	1.4%	5	4.7%
TOTAL	72	100.0%	107	100.0%

Table 6.34 Blade Core Initiation and Raw Material (complete cores only)

		Bagor		Gilund	
		N	%	N	%
Burin	Chert	6	35.3%	1	3.6%
	Quartz	11	64.7%	27	96.4%
BURIN TOTAL		17	100.0%	28	100.0%
Indeterminate	Chert	19	35.2%	4	5.4%
	Quartz	35	64.8%	70	94.6%
INDETERMINATE TOTAL		54	100%	100.0%	100%
Other	Quartz	1	100.0%	5	100.0%
OTHER TOTAL		1	100.0%	5	100.0%
TOTAL		72		107	

In some cases, there was no evidence of body or platform preparation. It appears that a natural ridge on the piece was strategically utilized to "start" the core. The first removal resembled a burin blow, but when done successfully, created two additional ridges with which the knapper continued his or her work. This type of initiation requires the appropriate raw material; it is difficult to do on rounded river cobbles for example. However, the quartz that is local to the regions around Gilund and Bagor naturally occurs in chunky blocks with multiple ridges. Many of these pieces also have flat areas that can serve as the platform and do not need to be prepared. For those that do not have flat areas, removing a single flake can create a nice platform from which to initiate blade

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removal. Extensive preparation was simply not required for most of the quartz in this region.

Burin-like Initiation

A core can also be made from a flake or flake-like piece of raw material. Just as a burin is made by striking the top of the edge of a flake, the initial blade can be made with a similar blow (Barton, et al. 1996; Coinman and Clausen 2000). Approximately one quarter of both Gilund and Bagor cores appear to have been initiated with this type of technique, which is an alternative to the crested ridge.

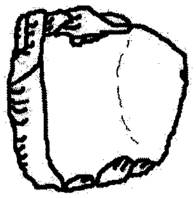

Figure 6.20 Gilund 5400023 Core-on-Flake with Burin-like Initiation.

Initiation Location

The location of initiation was also recorded. Three options were noted: initiation on-edge, initiation on-face, or indeterminate. Initiation on-edge is similar to a burin-like initiation. As with the initiation category, it was frequently not possible to determine where the initiation had occurred. When more blades had been removed, it was more difficult it to determine where the initiation occurred. The majority of blade cores at both sites were indeterminate. However, of the remaining cores, most had been started with

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an initiation on the edge of the core, instead of on the face. There is no significant difference in initiation location between Gilund and Bagor (Chi-square=0.0317; p<=1).

Table 6.35 Initiation Location

	Bagor		Gilund	
	N	%	N	%
Indeterminate	35	47.9%	44	41.1%
On-Edge	23	31.5%	37	34.6%
On-Face	15	20.5%	26	24.3%
TOTAL	73	100.0%	107	100.0%

Platform Count

Blade cores had either one, two, or three platforms (see Table 6.36, Blade Core Platform Count). Most blade cores at both sites had only one platform (Bagor: N=60, 82.2%; Gilund N=78, 72.9%). Blade cores with more than one platform were worked initially on one face; then the core was turned and the more blades were removed. Occasionally the blade scars intersected, leaving a residual crested ridge. However, in most cases, this ridge was at an awkward angle to any potential third (or fourth) platforms and was probably not used as an initiating ridge. This hypothesis is supported by the lack of crested ridge blades in the collections. The difference in platform numbers between Gilund and Bagor is not significant (Chi-square = 2.1032, df=2, p<=1). This indicates that the inhabitants of Gilund and Bagor had used similar core preparation techniques.

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Table 6.36 Blade Core Platform Count

	Bagor		Gilund	
Platform count	N	%	N	%
1	60	82.2%	78	72.9%
2	12	16.4%	27	25.2%
3	1	1.4%	2	1.9%
TOTAL	73	100.0%	107	100.0%

Removal Direction

The majority of blade removals at both sites were unidirectional. This is presumably because most blade cores had only one platform. Of the remaining blade cores, a variety of strategies were used for working the core. The majority of the remaining cores were rotated 90° before resuming blade removal. Second to this strategy was a bidirectional blade removal strategy such that the second platform was located on the opposite end of the core to the initial platform. Blade removals on the remaining cores appeared to be diverging, intersecting, or following three separate directions (tridirectional). The latter was only possible on cores with more than two platforms.

Table 6.37 Direction of Blade Removals

	Bagor		Gilund	
	N	%	N	%
90 Degrees	7	9.1%	11	10.3%
Bidirectional	5	6.5%	10	9.3%
Diverging	0	0.0%	1	0.9%
Intersecting	2	2.6%	3	2.8%
Tridirectional	1	1.3%	3	2.8%
Unidirectional	62	80.5%	79	73.8%
TOTAL	77	100.0%	107	100.0%

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Removal Location

As with removal direction, multiple locations of blade removals were noted. The "front" was assigned to the area that appeared to have the most recent blade removals. In nearly half of all cases from Bagor, and slightly less from Gilund, cores only had a "front." Of the remaining cores, most were only worked on the front and one side, the front and two sides, or the front and back. Very few cores were worked in other ways or on all sides. Unlike typical cylinder cores, which are worked on all sides, the cores from Gilund and Bagor are only partially worked.

Table 6.38 Location of Blade Removals

	Bagor		Gilund	
	N	%	N	%
Front	34	46.6%	45	42.1%
Front-1 Side	15	20.5%	17	15.9%
Front-2 Sides	15	20.5%	21	19.6%
Front-Back	5	6.8%	14	13.1%
Front-Bottom	1	1.4%	3	2.8%
Front-Side-Bottom	0	0.0%	1	0.9%
Front-Top	1	1.4%	2	1.9%
All-sides	2	2.7%	3	2.8%
TOTAL	73	100.0%	107	100.0%

Butt

When blade cores are held in a vise during blade removal, marks sometimes appear on the butt of the core. In order to determine whether a vise may have been used at Gilund and Bagor during the production of blades, the butt of all blade cores was examined with a 10x magnification hand lens. In total three cores from Bagor and one from Gilund evidenced wear on the butt (see Table 6.39 Wear recorded on Blade Core Butts). All of these cores were wedge cores made of quartz. Given the low number of

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cores with visible wear, it may be possible that either no vise was used, or that any vice in use was fashioned such that it did not leave marks on the butt. It is possible that the visible wear recorded may simply be attributed to post-depositional processes.

Table 6.39 Wear Recorded on Blade Core Butts

	Bagor		Gilund	
	N	%	N	%
No	70	95.9%	106	99.1%
Yes	3	4.1%	1	0.9%
TOTAL	73	100%	107	100%

Preparation of Back

The way that the back of the core (opposite the face with blade removals) had been prepared was recorded as one of four categories: blades, multiple flakes, single flake, or unworked (see Table 6.40 Preparation of Core Back). Both sites had a majority of cores that were unworked on the face opposite to the blades, although this was higher among Bagor cores. There is a significant difference between the two sites when considering whether the back was prepared or not (Chi square=9.5922, p<=0.01); Bagor had more cores with an unprepared back. The least common core back was comprised of multiple flake removals. Gilund had more cores with a single flake on the back side than with blades, while Bagor had equal numbers of cores with either blades or a single flake removal on the reverse. These numbers appear to be similarly distributed when considering raw material; that is, raw material does not appear to be associated with core back preparation. It is possible that the inhabitants of Gilund were using cores to produce both blades and flakes, whichever implement was needed at the moment of production.

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Table 6.40 Preparation of Core Back

	Bagor		Gilund	
	N	%	N	%
Blades	12	16.4%	18	16.8%
Multiple Flakes	6	8.2%	17	15.9%
Single Flake	12	16.4%	34	31.8%
Unworked	43	58.9%	38	35.5%
TOTAL	73	100.0%	107	100.0%

Back Shape

Most blade cores were not worked on the back. A variety of back shapes were apparent. Back shape was influenced by the direction and depth of flake or blade removals as well as the lack of any removals. Back shape is illustrated in Figure 6.21. The shape of the back was well distributed, although Gilund had 40% of blade cores that were flat on the back. This could be caused by many factors including the removal of a single large flake, the presence of other blades, or the natural state of unworked stone. "Y" shaped backs, Elongated "X" backs, and square backs were also common.

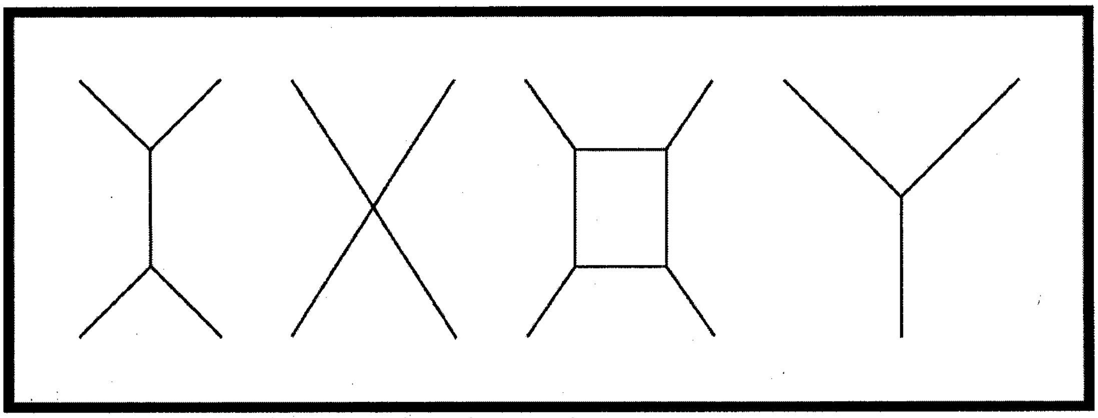

Figure 6.21 Types of Core Backs: Elongated X, X, Square, Y

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Table 6.41 Shape of Core Back

	Bagor		Gilund	
	N	%	N	%
Elongated X	11	15.1%	15	14.0%
Sideways X	4	5.5%	6	5.6%
X	2	2.7%	4	3.7%
Y	13	17.8%	17	15.9%
Convex-rounded	2	2.7%	2	1.9%
Flat	15	20.5%	43	40.2%
Variegated	10	13.7%	7	6.5%
Square	16	21.9%	13	12.1%
Grand Total	73	100.0%	107	100.0%

Bottom Preparation

The back is the area opposite the blade removals. In most cases it was not worked or a single flake had been removed. In very rare cases blades had been removed. Preparation of the core bottom did not appear to be an integral part of core preparation for most cores.

Table 6.42 Preparation of Core Bottom

	Bagor		Gilund	
	N	%	N	%
Blades	2	2.7%	2	1.9%
Multiple Flakes	4	5.5%	9	8.4%
None	40	54.8%	49	45.8%
Single Flake	27	37.0%	47	43.9%
TOTAL	73	100.0%	107	100.0%

Order of Preparation

Order of preparation was recorded in order to provide a basis of comparison with other regions (see Table 6.43 Order of Preparation). Kobayashi first developed a dichotomous typology in order to make sense of the proliferating core production techniques that were recognized in the archaeological record (Kobayashi 1970). He

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designated System A as those cores in which the blank or body was prepared before the platform and System B in which the platform was prepared before the body was shaped. In this study, four categories were noted: body prepared first, platform prepared first, indeterminate, and N/A (for cores that lacked either a prepared platform or a prepared body). The majority of cores at both sites fell into the N/A category, with a few falling into the indeterminate category. However, small numbers of cores from both sites were "readable." Bagor had a majority of cores in which the body was prepared before the platform, while Gilund had a higher number of cores in which the platform was prepared before the body, however, the difference is not significant (Chi square=2.8367; p<=0,10). It should be noted that as cores are worked and rejuvenated, it is possible for them to move back and forth between these categories.

Table 6.43 Order of Preparation

	Bagor		Gilund	
	N	%	N	%
Body	7	9.6%	3	2.8%
Platform	2	2.7%	5	4.7%
Indeterminate	4	5.5%	7	6.5%
N/A	60	82.2%	92	86.0%
TOTAL	73	100.0%	107	100.0%

Potential Cause of Discard

While it is not possible to definitively determine why any specific core was discarded, it is useful to examine flaws in cores at the time that they are discarded. For the majority of blade cores at both sites, no visible defect was evident (Bagor N=39, 51%, Gilund N=62, 58%). These cores appeared to be perfectly viable for the production of additional blades, but were discarded anyway. This indicates that conservation was

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perhaps not a top concern. Of the remaining blade cores (those with visible defects), the majority of cores at both sites had one or multiple visible hinge fractures. While hinges can be removed and the core repaired, in many of these cases it appeared that substantial preparation would have had to be done before the core became viable again. Interestingly, in many cases, the core appeared to be too small to work any further. Of course, skilled knappers can work very small cores and at what point a core becomes "too small" will vary between knappers based on their skill levels, and the haft which they are trying to fill. However, the cores in this category were very small indicating that perhaps they had been used to their full potential—or close to their full potential—before they were discarded. Surprisingly, very few cores were discarded because of perceived raw material flaws. While quartz is an awkward material, it does not appear to have caused the discard of most cores. These descriptions of core flaws should not be taken to be definitive recordings of the cause of discard, but should be seen as potential reasons.

Table 6.44 Flaws in Core at Time of Discard

	Bagor		Gilund	
	N	%	N	%
Fragment	2	5.3%	0	0.0%
Hinge	17	44.7%	28	62.2%
Platform damaged	4	10.5%	0	0.0%
Raw material flaw	5	13.2%	4	8.9%
Too small	10	26.3%	13	28.9%
TOTAL	38	100.0%	45	100.0%

Raw Material Analysis

The raw material analysis was conducted with the goal of identifying local and non-local materials. The majority of the lithics from both sites were made of locally available quartz. The remainder was made of chert, chalcedony, quartzite, basalt, and

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garnet (see Table 6.46 for breakdown), some of which is available locally, and some of which is not.

There is a significant difference in the distribution of raw materials (chalcedony, chert, quartz, and other) between Gilund and Bagor (Chi-square = 1008.6570, df=3, p<=0.001). Gilund has considerably more quartz overall (N=2432, 85.9%) compared to Bagor (N=663, 42.4%). Similarly, Bagor has more chert (N=773, 49.4%) compared to Gilund (9.8%). Both sites have relatively few artifacts made of chalcedony and other raw materials. As quartz is a local material, it appears that the inhabitants of Gilund are utilizing local materials more often than non-local materials, while the inhabitants of Bagor favor non-local materials. Since the inhabitants of Bagor are more mobile than those of Gilund, they would have had greater access to non-local materials.

Quartz

The quartz used by the inhabitants of Bagor is of a much higher quality than that used by the inhabitants of Gilund. Quartz is locally available at both sites, but fractures irregularly. The quartz lithics at Gilund appear to be larger than those of Bagor, presumably because of the way that the quartz fractured. Most of the quartz at Gilund simply was not fine enough to create very small lithics. Some quartz was of finer quality and those lithics tend to be smaller.

Chalcedony

At both Bagor and Gilund, most of the chalcedony was found amongst the blades (Bagor: 54.2%, N=58; Gilund: 64.7%, N=33). In fact, chalcedony had the highest proportion of blades of all materials (although quartz and chert were also mostly blades).

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That is, compared to the other raw materials found at these sites, chalcedony was most likely to be found in blade form. Flakes were the second most common form of chalcedony (Bagor 40.2%, N=42; Gilund 31.4%, N=16). Chalcedony cores and tools were rare at both sites.

At both Bagor and Gilund, there is a significant difference between raw material (chalcedony, chert, and quartz only) and dataclass (blade, flake, core, tool) distribution (Bagor Chi-square = 48.4529, df=6, p<=0.001; Gilund Chi-square = 23.6953, df=6, p<=0.001). That is, some raw materials appear to have been favored for particular types. For example, quartz cores were more common than cores of other materials. At Bagor, this may result from cores made from other, non-local materials being transported off-site. Because quartz is plentiful throughout the region, there is no need to transport it between sites. At both sites, there may also be a tendency to produce new quartz cores instead of investing time and effort into rejuvenating old ones. Since quartz is plentiful and intractable, it may be easier to start a new core when a flaw occurs in a given core. This could result in higher numbers of quartz cores being produced and discarded.

Other Raw Materials

The broad category of "other" raw material consisted of three materials: quartzite, basalt, and garnet (see Table 6.45). Quartzite and garnet are local to the area. Quartzite occurs in a variety of colors and qualities and was used for multiple purposes at Gilund including hammerstones, grinding stones, and slingballs. Because it is a local material and used for a variety of non "lithic" purposes, not all quartzite was included in this sample. Quartzite shatter, and medial and distal flakes without backing or retouch were not recorded since they may have simply been broken pieces of other artifacts. Quartzite

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cores, and complete and proximal blades, flakes, and tools were recorded and analyzed as lithics.

Garnet occurs locally in Southeastern Rajasthan and can be found as small nodules in the soil around the sites of Gilund and Bagor. Farmers commented that they find garnet regularly during plowing. Garnet is quite difficult to knap and instances of worked garnet as beads, pendants, or tools at prehistoric sites are quite rare. However, as the hardness for garnet ranges from 6.5 to 8.5, it is possible to knap some garnets. Six pieces of worked garnet were identified in the Bagor collection: four complete flakes, one proximal flake and one proximal blade. In addition, fourteen pieces of worked garnet were found at Gilund: eight complete flakes (one with retouch on the end), five complete blades, and one lunate. They were generally quite small, compared to the other materials, most likely because it occurs in very small nodules.

Basalt is local to the Deccan Region in the central part of India. The basalt that is closest to Gilund lies in the hills near the southeasternmost part of Rajasthan near the border of Madhya Pradesh. Large grained basalt was encountered in this region near Semara, which is approximately 40 km from Gilund. Fourteen pieces of fine grained basalt were identified at Gilund: eight blades (four complete and four proximal) and six flakes (five complete and one proximal). No tools or cores of basalt were identified. Moreover, no basalt was identified in the collections at Bagor. This is interesting given that the inhabitants of Bagor were more mobile than Gilund. However, the numbers here are quite low and it is perhaps possible that the inhabitants of Bagor did not range into the regions with basalt.

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Table 6.45 "Other" Raw Material

	Bagor N	Bagor %	Gilund N	Gilund %
Basalt	0	0.0%	14	20.3%
Quartzite	15	71.4%	41	59.4%
Garnet	6	28.6%	14	20.3%
TOTAL	21	100.0%	69	100.0%

Table 6.46 Raw Material and Dataclass by Site

		Bagor N	Bagor %	Gilund N	Gilund %
Chalcedony	Blade	58	54.2%	33	64.7%
	Core	1	0.9%	1	2.0%
	Flake	43	40.2%	16	31.4%
	Tool	5	4.7%	1	2.0%
CHALCEDONY TOTAL		107	100%	100.0%	100%
Chert	Blade	366	47.3%	148	53.2%
	Core	26	3.4%	5	1.8%
	Flake	344	44.5%	119	42.8%
	Tool	37	4.8%	6	2.2%
CHERT TOTAL		773	100.0%	278	100.0%
Other	Blade	7	33.3%	27	39.1%
	Core	1	4.8%	0	0.0%
	Flake	13	61.9%	41	59.4%
	Tool		0.0%	1	1.4%
OTHER TOTAL		21	100.0%	69	100.0%
Quartz	Blade	323	48.7%	1110	45.6%
	Core	66	10.0%	184	7.6%
	Flake	222	33.5%	1055	43.4%
	Tool	52	7.8%	83	3.4%
QUARTZ TOTAL		663	100.0%	2432	100.0%
TOTAL		1564		2830	

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Table 6.47 Dataclass by Raw Material at Gilund and Bagor

		Bagor		Gilund	
		N	%	N	%
Blade	Quartz	323	42.8%	1110	84.2%
	Chert	366	48.5%	148	11.2%
	Chalcedony	58	7.7%	33	2.5%
	Other	7	0.9%	27	2.0%
BLADE TOTAL		754	100.0%	1318	100.0%
Core	Quartz	66	70.2%	184	96.8%
	Chert	26	27.7%	5	2.6%
	Chalcedony	1	1.1%	1	0.5%
	Other	1	1.1%	0	0.0%
CORE TOTAL		94	100.0%	190	100.0%
Flake	Quartz	222	35.7%	1055	85.7%
	Chert	344	55.3%	119	9.7%
	Chalcedony	43	6.9%	16	1.3%
	Other	13	2.1%	41	3.3%
FLAKE TOTAL		622	100.0%	1231	100.0%
Tool	Quartz	52	55.3%	83	91.2%
	Chert	37	39.4%	6	6.6%
	Chalcedony	5	5.3%	1	1.1%
	Other	0	0.0%	1	1.1%
TOOL TOTAL		94	100.0%	91	100.0%
TOTAL		1564		2830	

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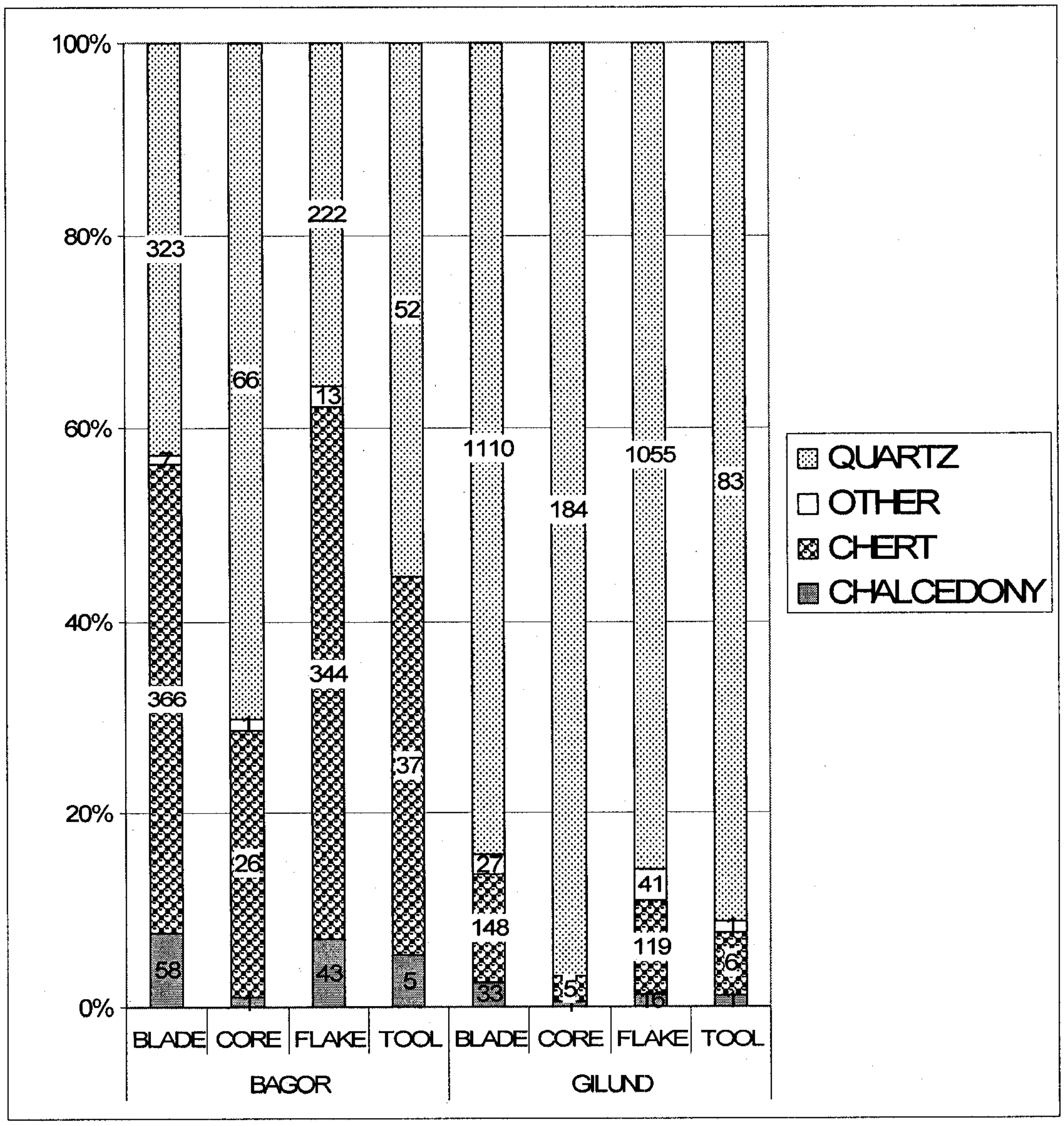

Figure 6.22 Raw Material by Dataclass at Gilund and Bagor

Interestingly, geometric tools at both sites are largely made of quartz (see Table 6.48 Geometric tools by raw material). Given the difficult nature of quartz to work, it was predicted that tools would have been manufactured of more fine-grained materials like chert and chalcedony. Quartz is more frequently used at Gilund, compared to Bagor, but this is in keeping with the high use of quartz for the production of other non-tool lithics.

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Table 6.48 Geometric Tools by Raw Material

		Bagor		Gilund	
		N	%	N	%
Isosceles Triangle	Quartz	2	66.7%	3	75.0%
	Chert	0	0.0%	1	25.0%
	Chalcedony	1	33.3%	0	0.0%
ISOSCELES TRIANGLE TOTAL		3	100%	4	100%
Lunate	Quartz	5	71.4%	21	95.5%
	Other	0	0.0%	1	4.5%
	Chert	2	28.6%	0	0.0%
LUNATE TOTAL		7	100.0%	22	100.0%
Rhomboid	Quartz	0	N/A	1	100.0%
RHOMBOID TOTAL		0	N/A	1	100.0%
Scalene Triangle	Quartz	12	63.2%	14	100.0%
	Chert	5	26.3%	0	0.0%
	Chalcedony	2	10.5%	0	0.0%
SCALENE-TRIANGLE TOTAL		19	100%	14	100%
Trapeze	Quartz	1	100.0%	2	100.0%
TRAPEZE TOTAL		1	100.0%	2	100.0%
Trapezoid	Chert	1	50.0%	1	100.0%
	Chalcedony	1	50.0%	0	0.0%
TRAPEZOID TOTAL		2	100.0%	1	100%
TOTAL		32		44	

Chert

Chert artifacts and samples from sources were analyzed in order to find potential matches between artifacts and sources. Chert material samples collected from the field were thoroughly described with an emphasis on the following features: quality, color, diaphaneity, inclusions, mottling, luster, patination, and heat-treatment (Table 6.49 Description of Chert Types). In addition, a number of chert types not located in the field were observed among the artifacts. New names were assigned to these cherts for ease of recording. These include anonymous cream, anonymous dark red, anonymous pink, anonymous brownish pink, anonymous pink bubblegum, and anonymous grey stripe. As

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the raw materials were identified through visual analysis only, they should be considered tentative until further analysis can be performed.

The chert types identified among the artifacts from Gilund and Bagor are presented in Table 6.50 Distribution of Chert types by site. Two observations can be made from this table. First, the majority of the chert from Bagor comes from an unknown source, while the majority of the Gilund chert potentially comes from one of four known sources. The difference between the two sites is significant (Chi-square = 127.2833, df=1, $p<=0.001$). Second, the inhabitants of Bagor appear to have used a greater variety of sources compared to Gilund.

Because the survey conducted as part of this study was limited in scope, it was not possible to identify all potential chert sources of Gilund and Bagor. While the inhabitants of Gilund appear to have heavily tapped the sources that were identified as well as the secondary deposits of the materials that originate there, the same cannot be said of the inhabitants of Bagor. Instead, they utilized sources that have not yet been identified and likely lie outside of the study area. Potential areas include the northeast of Madhya Pradesh, northern Gujarat, and the Ganeshwar-Jodhpura region. The inhabitants of Bagor were quite mobile compared to Gilund; they would have traveled through a larger landscape and engaged in exchange with more groups. The wide variety of cherts in their assemblage reflects this broad movement. Gilund inhabitants, on the other hand, appear to have gathered much of their chert from sources located approximately 40 km to the southeast. While the amount of chert is not sufficient to suggest organized trade in stone, the movement of chert may reflect either the mobility of some Gilund inhabitants or their exchange relationships with sites to the southeast, or both.

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Table 6.49 Description of Cherts

Raw Material	Description
CREAMS	
Anonymous Cream	10YR-8/2, sometimes mottled with feint 10YR 7/4; medium shine, sometimes with tiny geodes
Berugati Cream	When weathered appears as 10YR 6/2; has darker veins of 5YR 3/2, a few mm thick. Diaphenous. When fresh is appears more as 10YR 7/4 (although slightly paler) with very dark thin veins of red or occasional orange flecks. Very smooth with medium to high shine.
Semara Cream	10YR-5/4; patinates to 10YR 8/2 or paler. Outside of patina may be an orange gloss of 5YR 5/6. Chert may have red veins, black specs, or mottling of 10YR 6/2
PINKS AND REDS	
Anonymous Pink	10R 7/4 to 10R6/6 with black veins or red veins, sometimes with quartz veins and red mottles of 5R4/6 or 10R 5/4 or 5R 5/4; usually dull; sometimes has tiny geodes of less than 2mm in size. Shiny, smooth version is listed as heat-treated.
Anonymous Brownish Pink	Mostly 5YR 7/4, but may look like this because t he background melds with red veins and dots. Background may be 10YR 6/2; red swirls, veins and dots are always present
Anonymous Pink Bubblegum	10R-7/4 or 10R6/6 with white thin bands or veins about 1-2mm in thickness. Red dots of 5r6/2 or 10R6/2; these are really tiny geodes.. also possible thin (1mm) veins of 10R 5/4
Berugati Pink Olive	Mostly 5YR 7/2 or 10R 6/2 when fresh. Veins and highlights are olive. When weathered, looks more like 5YR 5/2. veins of black or N6. may have black or purple flecks. Slightly diaphanous, somewhat rough, low to medium shine
Berugati Pink-Red	10R 8/2 or 10R 7/4 or 10R 6/2 with red dots and red veins (made of red dots), veins appear as 10R 4/2, 5R 4/6 or 10R 4/6, black. They may be a few mm thick or even thicker. Also grains of quartz may be present. When weathered the body appears more as 5YR 7/2 or 5YR 6/4.
Berugati Red	5R 4/6; dull not translucent, with tiny geodes
Nathdwara Red	Conglomerate of chert and quartz; ranges from 5R 3/4 to 10 R ¾; dull and not translucent
Semara Red	Dull dusky red, 5R 3/4, with black veins and specks; quartz veins and specs, medium shine, brecciaed; sometimes mottled with 5R 4/6
Chitauriya red	dusky red 5R 3/4 with thin quartz veins; dull and not translucent

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Table 6.49 Description of Cherts (continued)

Raw Material	Description
GREYS AND BLACKS	
Bhagwanpura Black	Medium dark grey N4 to Dark grey N3; Mottling with grayish blue 5PB 5/2 and Medium dark grey N4; Diaphanous and glossy
Anonymous Grey stripe	Stripes of 10YR 4/2 and 10YR 6/2 with thin black bands that are 1-2mm thick.
Anonymous crazy grey	Bands of N4 or some other dark color with 10YR 6/2; very smooth, no other inclusions, medium shine, not diaphanous. Bands are usually several mm thick.
Berugati grey	N6, N7, N8, even5B 7/1 in range, red dots and veins possible. Outside may weather 10R 6/2 or 10YR 5/4; sometimes mottles of 5YR 8/1 and sometimes cortex present
Semara blue	N4, N5, N6, with mottles of 5YR 6/1. or N4, N5, N6; Sometimes just 5YR 6/1; cortex sometimes present, as are geodes; brecciaed
BROWNS AND YELLOWS	
Berugati Yellow	10YR 6/6 sometimes with small black specks or specs and veins of quartz; weathers pinkish on the exterior; dull, not translucent
Nathdwara Brown	Conglomerate of chert and quartz; ranges from 5 YR5/6 to 10YR 5/4; dull; small geodes present
Nathdwara Dark Brown	Conglomerate of chert and quartz;
Semara Brown	Jasper; 10 YR 5/4, sometimes with mottles of 10YR 6/6 or 10YR 4/2. may have very thin rough cortex, small geodes or quartz viens,
Semara Dark Brown	Conglomerate of quartz and chert; 10R 2/2; dull and not translucent
MIXED COLORS	
Semara Mixed	Chert has Semara red and Semara brown in the same piece
Semara Diaphanous	Just like Semara mixed, but translucent

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Table 6.50 Distribution of Chert Types by Site

	Bagor		Gilund	
	N	%	N	%
Anonymous Cream	85	11%	9	3.2%
Anonymous Dark Red	13	2%	0	0.0%
Anonymous Pink	64	8%	7	2.5%
Anonymous Brownish Pink	16	2%	0	0.0%
Anonymous Pink Bubblegum	10	1%	5	1.8%
Anonymous Grey stripe	4	1%	0	0.0%
Unidentified Chert	349	45%	66	23.7%
UNKNOWN SOURCE TOTAL	541	70%	87	31.3%
Berugati Cream	10	1%	1	0.4%
Berugati Pink Olive	6	1%	1	0.4%
Berugati Pink-Red	6	1%	3	1.1%
Berugati Red	1	0%	0	0.0%
BERUGATI TOTAL	23	3%	5	1.8%
Bhagwanpura Black	4	1%	1	0.4%
BHAGWANPURA TOTAL	4	1%	1	0.4%
Nathdwara Brown	2	0%	1	0.4%
Nathdwara Dark Brown	0	0%	1	0.4%
Nathdwara Red	1	0%	2	0.7%
NATHDWARA TOTAL	3	0%	4	1.4%
Semara Brown	69	9%	74	26.6%
Semara Cream	43	6%	1	0.4%
Semara Diaphanous	6	1%	9	3.2%
Semara Dark Brown	14	2%	5	1.8%
Semara Mixed	11	1%	30	10.8%
Semara Red	59	8%	62	22.3%
SEMARA TOTAL	202	26%	181	65.1%
KNOWN SOURCE TOTAL	232	30%	191	68.7%
TOTAL	773	100%	278	100.0%

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Table 6.51 Distribution of Raw Material by Region of Source

		Bagor		Gilund	
		N	%	N	%
Unidentified Chert	UNKNOWN SOURCE TOTAL	541	34.6%	87	3.1%
Southeast	Berugati Chert	23	1.5%	5	0.2%
	Bhagwanpura Chert	4	0.3%	1	0.0%
	Semara Chert	202	12.9%	181	6.4%
	SOUTHEAST TOTAL	229	14.6%	187	6.6%
Southeast and Deccan	Chalcedony	107	6.8%	51	1.8%
	Basalt	0	0.0%	14	0.5%
	DECCAN TOTAL	107	6.8%	65	2.3%
Local	Nathdwara Chert	3	0.2%	4	0.1%
	Quartz	663	42.4%	2432	85.9%
	Local Other Raw Material	21	1.3%	55	1.9%
	LOCAL TOTAL	687	43.9%	2491	88.0%
	TOTAL	1564	100.0%	2830	100.0%

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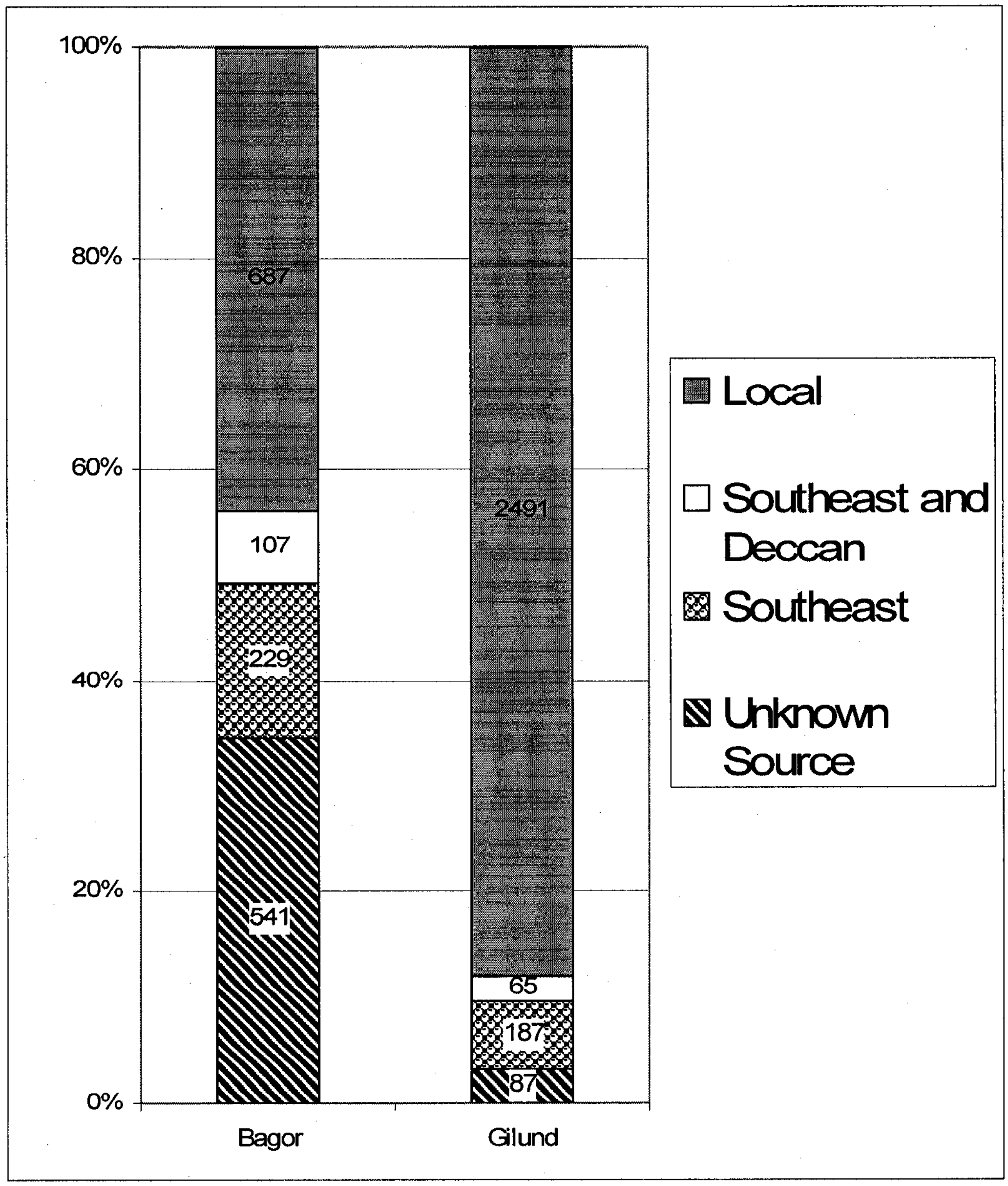

Figure 6.23 Distribution of Raw Material Sources at Gilund and Bagor

Misra does not speculate on the source of the chert and chalcedonies at Bagor. However, he does argue that the quartz is local. He writes, "Quartz and chert were the most common raw materials used and although quartz predominates in the waste material because of its intractable nature, the majority of the finished tools are of chert. The greater use of quartz was no doubt due to its ready availability in large veins in the schistose rocks just across the river" (Misra 1973:96). While the recent survey of the

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area across the river from Bagor identified the schistose rocks to which Professor Misra referred, very little knappable quartz remained. An admittedly brief perusal in the now dry Kothari River did not produce any samples of chert stones in the riverbed.

Sankalia, however, suggested that the cherts and chalcedonies from Ahar were plucked from the local rivers that bordered the site. Two pieces of supporting evidence can potentially support this claim. First, all of the types of cherts found at Gilund should be readily seen in the bed of the Banas River or identified from natural sources adjacent to the river. As discussed in the section on chert above, Nathdwara is the only source of chert identified on the banks of the Banas River and only Nathdwara cherts were found in the riverbed near the site of Gilund. While concentrations of chert deposition can change over time, the lack of multiple varieties of chert suggests that an alternative source should be sought.

Second, if the chert and chalcedony all came from the bed of the Banas River, then all lithic pieces with cortex should evidence signs of river-rolling. That is, the cortex should be smooth, rubbed, even, and rounded in appearance. In order to determine whether the cherts and chalcedonies at Bagor and Gilund came from the river or some other source, the presence and quality of cortex was recorded for each piece. Four categories were used: none, non-river-rolled, river-rolled, and indistinguishable.

The majority of cherts and chalcedonies from both sites exhibited no signs of cortex. In all, 49 pieces from Bagor and 12 from Gilund had cortex. For the majority of these pieces it was not possible to determine whether the cortex was river-rolled or not. The most common reason was that only a very tiny portion of the cortex remained. In all, however, 62.5% (N=10) of Bagor lithics with distinguishable cortex and 75% (N=6) of

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similar Gilund lithics clearly had non-river-rolled cortex (see Table 6.52 and Figure 6.24). While these numbers are very low, they are sufficient to support the idea that much of the chert and chalcedony from these sites came from other, more distant, sources.

Table 6.52 Cortical Evidence of Chert and Chalcedony Procurement from the River

		Bagor		Gilund	
		N	%	N	%
Chalcedony	None	98	91.6%	48	94.1%
	Indistinguishable	6	5.6%	1	2.0%
	Non-river-rolled	1	0.9%	1	2.0%
	River-rolled	2	1.9%	1	2.0%
CHALCEDONY TOTAL		107	100%	100.0%	100%
Chert	None	733	94.8%	269	96.8%
	Indistinguishable	27	3.5%	3	1.1%
	Non-river-rolled	9	1.2%	5	1.8%
	River-rolled	4	0.5%	1	0.4%
CHERT TOTAL		773	100%	100.0%	100%
TOTAL		880		329	

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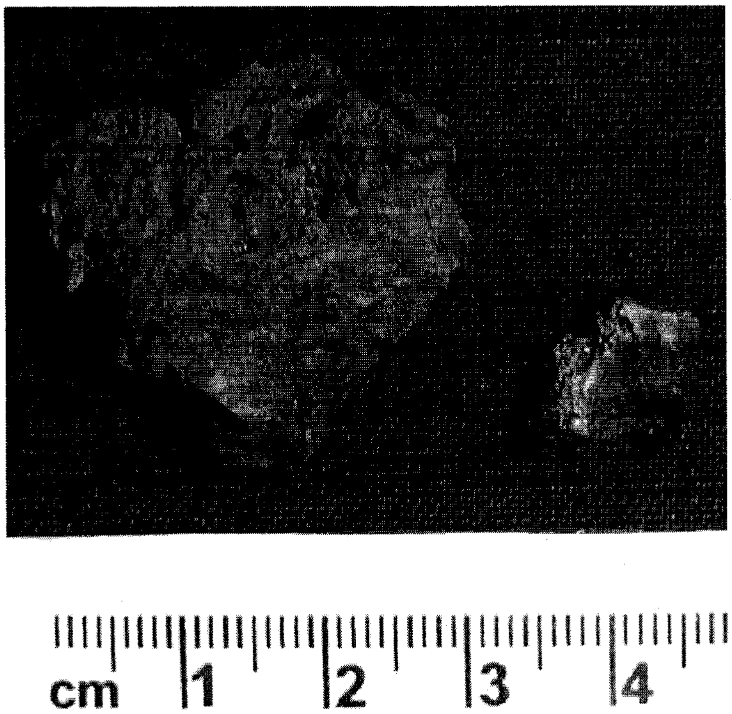

Figure 6.24 Bagor Semara Red Chert Complete Flakes with Non-river-rolled Cortex, Lot 1005[28]

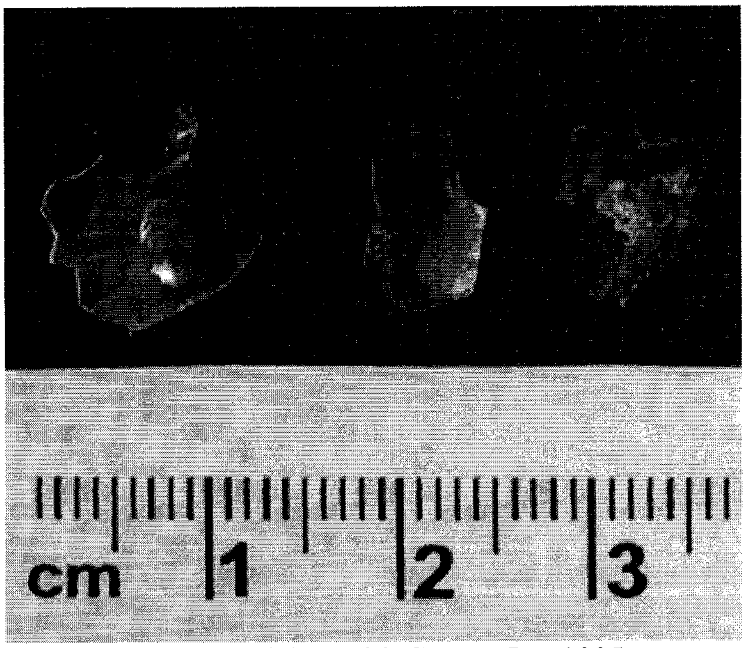

Figure 6.25 Bagor Flakes with Cortex, Lot 1005

[28] Lot 1005 is not in the data set for this study. However, only select artifacts were photographed, and this artifact may be considered to be representative of cortical flakes with no evidence of river-rolling.

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Summary

Three avenues of research were pursued in order to compare the lithics from Gilund and Bagor. First, a field survey was undertaken in order to identify potential raw material sources. This was paired with a visual raw material analysis on both raw material samples and artifacts. Second, a sample of the assemblages from each site was fully analyzed with a typology and attribute analysis. Finally, a sample of the cores from each site underwent additional attribute analysis.

Field Survey and Raw Material Analysis

The field survey focused on specific locations identified from the examination of geological maps or in consultation with area geologists. In addition, select limestone outcrops outside of a 25km^2 radius of the site of Gilund were field checked as were all limestone outcrops within that 25 km^2 radius. Through the field survey, five potential chert sources for the inhabitants of Gilund and Bagor were identified. These included Semara, Nathdwara, Bhagwanpura, Chitauriya, and Berugati. Nathdwara had a very distinctive poor quality chert conglomerate of red and yellow. Because it is located adjacent to the Banas River, and upstream from Gilund, the chert can be found in the riverbed and it is likely that the inhabitants of Gilund could have procured that chert from the river. Different varieties of red, yellow, and black cherts were available at all of the remaining sites except for Bhagwanpura, which had a bluish-black translucent chert. Chalcedony was found at Semara. Evidence of microblade and microlith production was identified at all of the sites except for Nathdwara. However, limestone quarrying and erosion in the hills examined may have obscured any remaining artifacts. In addition, low densities of Acheulian handaxes, bifaces, and Levallois cores were found at Semara.

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The deposits of cherts are very small and the geological maps of the region do not all note the presence of chert. It is possible that additional chert sources exist in the region.

The raw material analysis showed a significant difference in the distribution of raw materials between Gilund and Bagor. Gilund has more quartz while Bagor has more chert. Some raw materials may have been favored for particular lithic types. For example, cores were most frequently made of quartz as were geometric tools of both sites. The majority of Bagor chert comes from unknown sources. However, the majority of Gilund chert appears to have come from one of four sources identified through the field survey. It appears that Bagor used a greater variety of sources than Gilund. This is most likely due to greater levels of mobility.

The field survey and raw material analysis show that both sites rely heavily on local materials but that they also use materials that may come from as far as 60 km away. Most non-local material seems to have been obtained either sporadically or incidentally; there does not seem to be a system of organized procurement as in the Indus. Many of the sources for Bagor and some for Gilund remain unidentified. The material landscape of Bagor is potentially much larger than that of Gilund.

Typology and Attribute Analysis

The analysis of collections indicates that Bagor has more blades and tools and Gilund has more flakes and cores. However, when comparing the distribution of flakes and blades at both sites, there does not seem to be a significant difference. Both sites seem to have similar distributions of geometric tools. That is, while Bagor has more tools in general, it does not seem to have more of any one type. No transverse

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arrowheads or oblique blunt points were identified at Gilund, which also had significantly fewer microburins and more burins.

There is no significant difference in the ratio of backed to non-backed blades between the two sites. There is also no significant difference in the location or type of backing used between the two sites. However, there are significantly more backed flakes at Gilund. This may result from the use of elongated flakes in the place of blades at Gilund. At both sites a majority of blades were prepared by the removal of a single flake on the platform. However Bagor had significantly more blades prepared in this way. Gilund had more unprepared blade platforms as well as platforms with edge preparation only. There was also a significant difference in the platform preparation strategies of flakes between the two sites. However, this difference may be caused by higher rates of missing platforms.

Bagor lithics are smaller than those from Gilund, in general. At both sites quartz lithics are the largest, followed by chert, then chalcedony. This may be caused by the quality of the material. Average blade length is smaller than average core length at both sites, which is an unusual finding that hints at the way cores were produced. Chalcedony blades and chert tools are wider at Gilund, although it is not clear why this may be so. There is no significant difference in thickness of artifacts between the two sites. At both sites, types made of quartz were the largest. At Gilund, chalcedony flakes and tools are larger than ones made of chert, however, other chalcedony items are smaller than those made of chert. At Bagor, all chalcedony types are smaller than chert, which are smaller than quartz.

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Core Analysis

Both sites had more blade cores than flake cores, however, Gilund had significantly fewer blade cores than Bagor. Although the majority of cores at both sites were made of quartz, Gilund had significantly more quartz cores than Bagor.

Core shape was interesting at both sites. Neither site had a full cylinder or pyramid core in the sample. At Bagor, the majority of the cores were wedge-trapezoid, then block, then amorphous, then wedge-triangle. At Gilund the majority were amorphous, then wedge-trapezoid, then flat, then block. There was a significant difference in the distribution of types between the two sites. At both sites most cores were worked from front to back; this was followed by flexibly worked cores, and then rotated cores. There was no significant difference between the sites for these three classes.

At both sites, most cores were prepared by the removal of a single platform. This supports the findings for blade platform preparation. Unprepared platforms were the second most common preparation technique at both sites. There is no significant difference between the two sites for core platform preparation. However, the difference in platform preparation among chert cores between the two sites is significant; nearly half of Gilund cores had no platform preparation while Bagor had few chert cores with no platform preparation. Over one-third of Bagor cores had platforms with multiple flake removals while only a few Gilund cores had been prepared this way. Among quartz cores, Gilund has significantly higher numbers of non-prepared core platforms. Flake core platforms were mostly unprepared at both sites. Most blade cores at both sites had

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only one platform. The difference in platform numbers between Gilund and Bagor is not significant.

Core body preparation techniques were also recorded. Most cores at both sites show no evidence of body preparation prior to knapping. There is no significant difference between Gilund and Bagor for prepared or unprepared bodies. There is also no significant difference between Gilund and Bagor for body preparation techniques. In all, 25% of Bagor and 21% of Gilund blade cores show neither body nor platform preparation.

For 25% of the Bagor collection and 31% of the Gilund collection initiation was identifiable. Nearly one-quarter of identifiable Gilund and Bagor cores have burin initiation. No crested ridges were identified in the study sample.

Three commonly held assumptions about blade cores in India were tested. First, it is clear that crested ridges should not be used as temporal markers. While crested ridges are common during the Chalcolithic in many regions, they are not common at either Bagor or Gilund. Thus, the absence of crested ridges at a site does not mean that the site predates the Chalcolithic. Second, there is some support for the idea of regional traditions in core technologies. Multiple core technologies were identified in this study, however, there appears to be a preference for the use of natural ridges and burinated initiations. Finally, there is no evidence to support the idea that South Asia communities who favor different subsistence or mobility strategies also utilize separate core preparation techniques. Instead, they appear to share common techniques.

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Chapter 7. Discussion and Conclusion

The original excavations at the site of Bagor (Misra 1973) uncovered some Ahar-Banas sherds, steatite beads, and copper-bronze spearheads, which provided evidence for interaction with sites of the Ahar-Banas Cultural Complex like Gilund. Drawing from ethnographic studies on hunter-gatherers, researchers had argued that the inhabitants of sites like Bagor were separated from the Ahar-Banas Cultural Complex by ethnicity and linked through trade and exchange. Since exchange does not occur in a social vacuum, this project set out to find evidence for additional connections between these two communities. As lithics were the only artifact class held in common by both microlithic scatter sites and sedentary sites, this project selected that artifact class for analysis. The study of lithics also provided an entryway for considering technological practices and technological knowledge. Bagor and Gilund were selected for study since they were representative of each of these sites –the former a microlithic scatter and the latter an early farming settlement—and because recent excavations had been undertaken at these two sites.

Informed by the viewpoint that technology is culturally embedded, the study pursued three avenues of research. First, an attempt was made to identify raw material sources so that the material landscapes of Gilund and Bagor could be mapped and compared. Second, a sample from the lithic assemblages of each site was fully analyzed in order to identify points of variability as well as common technological practices. Finally, core production strategies were closely examined in order to determine to what extent the inhabitants of the two sites shared a common technological skill set. Together,

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these three lines of research provided a way to bridge the gap between Gilund and Bagor, and by extension temporary camps and permanent settlements of southeastern Rajasthan in the second and third millennium BC.

Material Landscapes and Raw Material

Part of this research project identified lithic artifact raw material and potential raw material sources in the Mewar Plain. Multiple geological maps were checked in consultation with local geologists in order to identify areas where chert had previously been noted. These areas were ground-proofed and several sources of chert were found as well as one source of chalcedony. A range of artifacts found at these sites included Acheulian handaxes, Levallois flakes, and microblade cores, blades, and microlithic tools, indicating long-term use of these sources. Most of these sites were located approximately 40 km southeast of Gilund near the border of the modern state of Madhya Pradesh, and near the modern villages of Semara, Bhagwanpura, Berughati, and Chitauriya. Although these sources are not located near rivers, each is associated with a small seasonal *nulla* that connects to the tributaries of the Kothari River. Therefore, secondary deposits of these sources may potentially be found in either the tributaries or even the Kothari River, which passes 20 km to the south of Gilund. One additional source at the site of Nathdwara, west of Gilund, was also identified. However, this source is located on the River Banas, upstream from Gilund; Nathdwara chert was found in the Banas River and likely could have been gathered from the local river bed near Gilund.

The lithic artifacts from Gilund and Bagor underwent a visual raw material analysis. The results show that the raw material procurement strategies differ between

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Gilund and Bagor. Six raw materials were used at both sites: quartz, chert, chalcedony, quartzite, basalt, and garnet. The assemblages from both sites were overwhelmingly comprised of a single locally available material: quartz. Nathdwara chert, present at both sites, was deemed to be local, because it is found in the Banas River. However, non-local materials—cherts, chalcedony, basalt—were also used by both sites. Basalt, available in the Deccan region to the southeast of Gilund and Bagor, was found in very small quantities. The Gilund collection was comprised of 88% of local materials while the Bagor collection only had half of that amount at 44%. These figures only refer to complete and proximal artifacts; medial and distal pieces (except for tools, backed, retouched, and truncated pieces) and shatter were not included in this study. A broader study with omitted materials may show different percentages of local versus non-local materials. It is clear that Bagor used more non-local materials than Gilund, which may result from the higher levels of mobility by the inhabitants at Bagor.

It appears that most people made stone tools by obtaining the material in the course of their usual daily routines in the area around "home." Quartz is plentiful near both sites, and while the quartz available near Bagor is of much higher quality, and therefore easier to knap, the material near Gilund is still usable. Quality seemed to be of less importance than ease of procurement since high quality stone material such as chert and chalcedony is located a bit further away to the southeast of both sites. Both communities used small quantities of these non-local materials. Unlike Indus sites that imported vast quantities of lithics through a sophisticated network of traders and artisans, the people of Gilund and Bagor were obtained non-local materials incidentally. It is

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possible that for both sites stone procurement may have been incorporated into trips to the southeast, although small-scale exchange is also a possibility.

In addition to using more chert than Gilund, it is clear that Bagor utilized a wider variety of cherts. Higher levels of mobility would have enabled the community from Bagor to regularly encounter a wider variety of raw materials and thus utilize them for stone tools. Through visual analysis, this project matched lithic raw material at each site to raw material encountered in survey. It was only possible to positively identify 30% of Bagor chert as coming from these sources. In contrast, 70% of Gilund chert appears to have come from identified sources. This means that Bagor is not only using more sources than Gilund, but that they are using some separate sources as well. It appears that 67% of Gilund chert likely comes from southeast; while only 40% of Bagor chert likely comes from the same areas. This conclusion is based on visual analysis and it has not yet been definitively demonstrated that identified cherts come exclusively from that region. However, the broader Mewar Plain has very few chert deposits and targeted survey did not identify other chert sources. That is, while it may not be possible to completely rule out other potential sources for the identified "Semara cherts" (or "Bhagwanpura chert" or "Chitauriya chert", etc.), there is clearly a difference between the cherts that Gilund and Bagor are using. Bagor is using more "unknown" cherts because they are gathering them from a source area not included in this study. This indicates that Gilund and Bagor favor different chert sources when procuring non-local cherts or that they traveled in different areas.

One other factor to consider is the source of the quartz artifacts. While quartz is locally available to both sites, it is also available in quantities throughout the Mewar

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Plain. It was not possible to distinguish quartz source origins through visual analysis and for the purposes of this study it was assumed that all quartz was procured locally. It is certainly possible, however, for certain portions of the quartz artifacts to have been made of quartz obtained from a non-local source. This means that while it is stated here that Bagor has 44 % "local" material and Gilund has 88% local material, those numbers could actually be much lower.

The findings suggest that the material landscapes of the two sites only partially overlap and that the landscape of Bagor is much broader than that of Gilund. It should be kept in mind that lithic raw material only forms one part of this landscape. Other raw materials, crafts, food goods, and other communities also comprise part of the landscape. This study demonstrates, however, that Gilund and Bagor share similar knowledge about some places, but not others. In sum, there is some evidence for connection here, although there is also evidence that the two communities may have operated in different spheres.

Lithic Assemblages: Variability and Technological Practices

The samples from Gilund and Bagor were analyzed according to the typology set out by Misra 1973. In addition, multiple metric and non-metric attributes were recorded in order to identify similar technological practices between the two groups. Lithic assemblage composition is affected by many factors including mobility, subsistence, non-lithic craft production, and raw material. This lithic analysis provided some insight into those practices and strategies.

Both Gilund and Bagor emphasize blades and blade cores over flakes and flake cores. Geometric tools like lunates, triangles, and trapezes are found at both sites, while more complicated tools are not present. Both sites have the same repertoire of types

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which appear to have been made with the same techniques, including blade manufacture and microburin removal for geometric tool production. Backing techniques appear to be the same at both sites: mostly obverse, with some inverse or a combination of obverse and inverse. While the presence of a similar typological distribution is not in itself very telling, it is interesting that neither site diverges from the repertoire.

Blades and blade cores are considered to be the result of formal technology, while flakes and flake cores are considered to be more expedient. Informal lithics are more commonly associated with settled sites, and formal lithics are more commonly associated with sites of mobile people (Parry and Kelly 1987). The ratio of blades to flakes and blade cores to flake cores between Gilund and Bagor indicate that both sites preferred a formal technology over an informal technology. However, it appears that Bagor had higher percentages of blade cores, blades, and tools, indicating that the lithic technology utilized there was somewhat more formal than Bagor. Other features of the assemblages support this conclusion. For example, the flakes and flake cores at Gilund had higher percentages with unprepared platforms, indicating that flakes were frequently made more expediently than at Bagor. It would be an overstatement, however, to call Gilund's lithic technology informal. It appears that the Parry and Kelly pattern where informal lithics are more commonly associated with settled sites, and formal lithics are more commonly associated with mobile sites (1987) does not seem to easily apply to this case. The alternative model where raw material is the single biggest determinant of formal versus informal technology (Andrefsky 1994), also does not seem to hold. It is possible that these models, which were built on biface technology, may not apply to lithic technologies based on blade and microlith production.

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Lithic assemblage variability can also be affected by concentrated craft production since some manufacturing processes depend on lithic tools (Kenoyer and Vidale 1993; Odell 1998, 2003; Piperno 1973). The distribution of tool types appears to be similar between Gilund and Bagor, and there do not appear to be large numbers of items like drills. This indicates that neither site was using lithics in a concentrated way for production of crafts. To some extent, at Gilund, this may be influenced by the location of excavation units; it is likely that many craft workshops lie unearthed beneath the soils of the mound.

Core Production

Blade cores can be produced a variety of different ways. The blade core production techniques of Gilund and Bagor were compared in order to determine to what extent the inhabitants shared similar technological traditions and skill sets. Both sites use multiple approaches to core production and blade removal. However, in general, it can be said that Gilund and Bagor share similar core production technologies. Gilund cores appear to be more similar to those of Bagor than to those of the Indus. Previously it had been expected for Gilund lithics to more closely resemble other lithics from contemporaneous permanent settlements. Although it is not urban, Gilund shares many similarities with Indus sites: it is a mound that was once occupied by farmers and artisans; it has communal buildings, and actively engaged in local and long-distance trade and exchange. It was not expected for Gilund to share a technological tradition with Bagor, since they differ in terms of mobility and subsistence strategies, and because the occupants of Bagor had been considered to be a distinct group. For these reasons there is an assumption that the lithic technology at Gilund would have more in common with

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Indus sites than with nearby Bagor. But the evidence actually points to the opposite; Gilund core preparation is quite dissimilar from Indus cores. A review of the archaeological literature also suggests that Gilund lithics differ from those found at settled agricultural villages of the Deccan. Instead, Gilund lithic technology most closely resembles that from Bagor. The cores at Gilund and Bagor share a number of features including a preference for the use of a burinated initiation, or a natural ridge instead of a crested ridge, preference for wedge or block shape instead of cylindrical, the use of flakes as pre-forms, minimal or no platform preparation, and minimal or no body preparation.

Many cores at Gilund and Bagor were initiated with a burin-like blow. This was observed on several cores that had only a single, two or three blades removed, but where the initial removal scar was still present. While most of the cores did not have observable traces of the initiating blow, approximately 25% of the cores from both sites exhibited a burin-like initiation. Natural ridges present in the raw material were used to guide the initial removal. In some cases the use of a burin-like initiation was facilitated by the use of large flakes as core pre-forms.

In many parts of South Asia, a crested ridge is the preferred initiation technique. This is true in the Indus, the Deccan, and in the south. Crested ridges are also common throughout the Near East in the Neolithic and Chalcolithic. Crested ridges are most useful when the raw material is round or when trying to produce long, thin blades. Material used in the Deccan usually consists of small rounded river nodules. While this is not true of Indus material, Indus blades tend to be longer than those of southeastern Rajasthan, which are among the smallest in India. It appears that neither of these factors held true for Gilund and Bagor. Crested ridges are also missing from cores of mobile

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sites in Gujarat and in some mid-Holocene hunter-gatherer sites in central India. In my analysis, crested ridge blades or flakes were absent in the sample selected from both Gilund and Bagor.

The main raw material at both sites, quartz, has abundant natural ridges. It appears that these natural ridges were used instead of creating crested ridges. The absence of crested ridges at Gilund and Bagor should not be taken to indicate that the cores were prepared offsite. First, most of the raw material is found locally. Second, there is evidence that cores were initiated at Gilund and Bagor; for example there are cores with only one, two, or three blade removals, where the initial blade scar is still present. In addition, substantial debitage at both sites points to onsite manufacture. Finally, it appears that either natural ridges or burinated initiation was used instead of the crested ridge in most cases.

After the initiation, the cores were worked more like wedge-cores of Asia than cylindrical cores of the Near East and Mesopotamia. While typical wedge cores start as a biface, but Gilund and Bagor cores are minimally prepared prior to blade removal. Like other wedge cores, blades were removed from a flat surface by working from front to back in the same way that a loaf of bread is sliced. The core was not turned or rotated as the removals progressed, as in cylinder cores. Cylinder cores are among the more common blade core shape at Indus and Deccan Chalcolithic sites.

Overall, Gilund and Bagor have a variety of core shapes. While core shape is influenced by raw material quality and proximity, it should also be seen as the last stage in a series of blade removals. In this case, it is clear that the removals occur in similar ways, and potentially with similar vises. A variety of blade core shapes are present at

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both sites, but these shapes are quite similar to each other and different from other regions. These shapes are the end result of core reduction strategies.

Like technological strategies, core shape may be influenced by raw material, both the quality and the proximity. High quality crypto-crystaline materials can be knapped in more predictable ways than materials like quartz. So quality may partially determine both initiation and the ultimate core shape before discard. When material is not locally available, more efficient blade removal techniques may be utilized. In this situation, a preference for cylindrical cores may be noted since they utilize raw material more efficiently than wedge or block shaped cores. At Bagor and Gilund, the material is mostly local, and therefore there is no need to be efficient.

Bagor, Gilund, and the Ahar-Banas

Ethnographic research presents two possible ways to model the relationship between Bagor and other Ahar-Banas sites, like Gilund. First, review of archaeological and ethnographic research on hunter-gatherers suggests that the inhabitants of Bagor may have engaged in an exchange relationship with other people of the Mewar Plain. Exchange was likely to be predicated on long-term relationships. The alternative model is drawn from work on pastoral transhumants, such as those who occupy the region today. In this model, temporary camps like that of Bagor may have been occupied by a community of pastoralists who resided in the permanent settlements of the region during some seasons. While they cannot be considered to be a distinct "group," they are a distinct community during the time in which they are isolated from the village. While the study of technology alone cannot definitively support either model, the results contribute to our understanding of the region. Through the study of lithics it has become apparent

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that these communities have partially overlapping material landscapes, a divergence of technological practices, and a shared lithic production skill set. The study of technology has challenged simplistic models of cultural boundaries and helped to detail long-term shared histories.

Broader contributions

This dissertation contributes to the literature on social difference in the ancient past, lithic technology, archaeology of South Asia and particularly southeastern Rajasthan.

Social Difference

In addition to engaging with questions about the relationship between technology and culture, this dissertation provides a potential method for finding links between mobile and sedentary communities beyond the transfer of material objects. In this dissertation, social difference is considered in terms of apparently different communities co-existing within the same region. Settled farmers and nomadic or transhumant pastoralist/hunter-gatherers shared partially overlapping landscapes in many parts of the world during the time of early food production. Many archaeologists have identified interaction between such communities in the Near East, Europe, and North America. Usually, the presence of artifacts that were manufactured in farming settlements or cities and recovered from temporary camps indicate interaction between groups. This dissertation looked beyond the presence of goods to find evidence of shared traditions and histories through the identification of the presence of a common lithic skill set as well as common lithic technological traditions. Engaging in overlapping traditions and

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producing items in socially prescribed ways enacts and demonstrates membership in a community. In this case, the perceived relational distance between hunter-gatherer/pastoralists and farmers has been challenged.

Lithic Technology

Lithics in societies that produce metal frequently receive much less attention than those from earlier time periods. This is unfortunate because lithic technology was used for millennia after the introduction of metal (and in fact, is used today in some regions). Lithic technology of any age has the potential to be a venue for the study of multiple questions about technology and culture. It is hoped that this dissertation will contribute to that particular gap in the literature. The methods used in lithic analysis were comprehensive and included raw material analysis, typology, attribute analysis, and a special focus on one class of artifacts.

Archaeology of South Asia

The history and prehistory of South Asia is full of examples of mobile and settled peoples living side by side and engaging in trade and exchange. This dissertation adds to theoretical and methodological approaches to understanding this interaction. By drawing from ethnographic research on pastoralists, it is possible to expand the number and types of potential forms of community formation and interaction. Methodologically, a consideration of technology allows us to surpass current understanding of prehistoric interactions which have largely been based on the presence of stylistically recognizable ceramics, beads, and copper implements at the sites of temporary camps.

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Few comprehensive lithic studies have been conducted on South Asian materials. This analysis incorporated both attribute and raw material analysis along with the standard typology. It is hoped that this study will offer sufficient data to provide a means of comparison with lithics from other sites in future studies. More importantly, this research demonstrates that a thorough analysis of lithics brings to light previously unknown aspects of lithic technology, such as the use of a burin blow instead of a crested ridge for the initiation of cores in some regions of South Asia. The systematic analysis of cores undertaken here is one of the first of its kind in South Asia. Most analyses of microlithic collections focus on the blade and tool elements. However, further examination of the unique and highly variable cores across South Asia will help to build a framework for lithic production.

Finally, through the study of lithic technology, it is possible to begin a framework for understanding social and economic interactions in Northwest India in the third millennium BC. In recent years a number of sites have been excavated in this little understood region which allows researchers to begin to make broader synthetic statements about the region. This dissertation is one such contribution to that conversation.

Remaining Questions

A number of questions remain after this research. While it is hoped that this study contributes to our understanding of interaction between mobile and settled societies in Northwestern India in 3000 BC, the structure of this relationship is still unclear. In addition, the political structures that may have existed in the region have not yet been explained.

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The relationship of lithic technology to other technologies has not yet been explored in this region. Raw material procurement for other crafts produced at Gilund such as copper, pottery, or lime production should be examined. In addition, further excavation of deeper levels at Gilund would permit a chronological comparison of the lithics and other technologies practiced at that site.

Bagor remains the most significant third millennium BC temporary camp site in South Asia to be excavated. However, it is still unclear to what extant the fauna collection contains wild or domesticated animals. The fauna collection remains to be fully reanalyzed. In addition, hundreds of similar sites are located throughout the region and into Gujarat. Further excavation of similar sites would provide a much needed comparative framework and would indicate whether or not Bagor is unique. The connections between the mobile people of Gujarat and Rajasthan also should be explored.

The comprehensive analysis of lithics brought to light some new revelations about the composition of the lithic assemblages as well as specific skill sets. At present some of these techniques, like the use of the burin initiation appear to be unique to Rajasthan, and possibly some sites in Gujarat and central India. Further research on core attributes throughout the subcontinent will help to define how widespread this technique can be found.

Finally, the unidentified raw materials from this study remain unexplained. The people from Bagor were using material from alternative sources. Additional survey can locate those sources. Archaeometric analyses of the Gilund and Bagor materials can also verify the visual analysis performed here.

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Conclusion

Current understandings of farmer-hunter-gatherer/pastoral relations emphasize differences in subsistence and mobility practices and a linkage through trade and exchange. This study has attempted to expand this understanding by looking at evidence for a shared social history through overlapping material landscapes, technological practices, and shared skill sets. These three factors help to provide insight into the relationships evidenced by trade and exchange between communities of the Mewar Plain.

This study of lithic technology from two sites in Rajasthan, India—Gilund, a sedentary agro-pastoral village and Bagor, a camp of mobile hunter-gatherer/pastoralists—focused on raw material procurement strategies, lithic assemblage variability, and core production strategies in order to discern areas of overlap and shared history within the region.

It is clear that the material landscapes of Gilund and Bagor partially overlap and are partially distinct. This indicates that Gilund and Bagor may have engaged in the same world, but that they also had separate spatial knowledge and relationships with communities in different places. The raw material analysis indicates that the world of Bagor was much bigger than that of Gilund, but this may be challenged by analysis of non-stone materials.

The lithic assemblages of both sites shared a number of common features including their emphasis on formal technologies. Gilund utilized a slightly more expedient technology, but not appreciably so. In general, it appears that the technological practices of the two sites are somewhat different.

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The lithics from both Gilund and Bagor share a variety of core production strategies that differ from other regions in South Asia, with the possible exception of Gujarat. Blade core technologies are comprised of specific techniques that must be performed in the proper sequence. They are learned technologies that require some skill. That is, there is more than one way to make a lithic blade, and each one must be learned. When sites use similar core technologies, it indicates that they have a common skill set that was obtained by sharing knowledge or having a shared history; they have a shared sense of the proper way to manufacture items. Often, people are aware of multiple alternatives for making a particular craft item like lithic blades, but they persist in following the technological traditions of their community (Weissner 1984). The artisan, in this case the flint-knapper, uses culturally constructed knowledge as he or she works (Lemonnier 1993b; Pfaffenberger 1992; Sellet 1993). Engaging in technological activity and craft production is not just derivative, but also creative. Everyday actions and habits like craft production and technological practices comprise and reproduce culture. That is, flint-knapping is social reproduction. In continuing to make lithics in the same way every day for hundreds of years, instead of incorporating innovations, the members of these communities were reinscribing the "correct" production techniques and in fact, confirming the definition of a "correct" core. The act of producing a "correct" core links members of a community with those of nearby communities who also use "correct" techniques. It is shared practices like crafting that show and enact membership in a community (Bartlett and McAnany 2000).

The utilization of this unique technology hints at a shared social history between Gilund and Bagor that allows us to look beyond trade as the only link between the

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members of these two communities. That the inhabitants of these two sites employed a shared technique demonstrates a close communicative relationship either during the time that both sites were inhabited, 3000 to 1700 BC, or at some point previous to that. That is, these two communities clearly shared both knowledge and a history.

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Appendix 1—Site Survey Transect Form

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Gilund Region Raw Material and Site Survey – Transect Form

Name of Site/Place:____

Transect #_____ Date: __________________ Initials: ______________

Previous Transect #_____ Distance & direction from previous transect _____
Datum Longitude: _________________ Datum Latitude: ________________
Distance & direction from datum

Description of terrain:
Rocks, soil____

Vegetation____

Groundcover: Low______ Med_______ High_______

Slope: 0-5°____ 5-15° _____ 15-30° _____ 30-45° _____ 45° +______

Other:

Disturbance: Quarrying_______ Construction______
Cultivation________________
Other disturbance____
____

Description of artifacts found (count per meter^2):

	Pottery				Lithics				Other
Meters	0	1-3	3-10	10+	0	1-3	3-10	10+	
0-50									
50-100									
100-150									
150-200									
200-250									
250-300									
300-350									
350-400									
400-450									
450-500									

Comments on artifacts found:

Artifacts collected____

Recommendation for further collection:___________________________________

Other Comments:

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Appendix 2—Surface Collection Form

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Gilund Region Raw Material and Site Survey – Surface Collection Form

Name of Site: ____

Datum Longitude: ____________________
Datum Latitude: ______________________
Date: __________________Initials: ________________

Collection unit #__________ Random______ Targeted______
Location of collection unit:______________________________
____

Size of collection unit:_________________________
Slope: 0-5°____ 5-15°____ 15-30°____ 30-45°____ 45° +____

Artifacts Collected:
Pottery_____ Lithics_____ HS_____ Slingball_____ Bead_____
Other____
Artifacts not collected: Fauna_____ GS_____ Other___________

Comments:

Name of Site:____

Collection Unit #____________

Washing instructions: _________________________________

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Appendix 3—Site Summary Form

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Gilund Region Raw Material and Site Survey – Site Form

Name of Site: ____

GPS1:
GPS2:
Dates:

Nearby landmarks:

How located:

A. Previously known (details):
   ____
B. Newly found (details):
   ____

Site size: N-S_________E-W_________ Height__________# of Mounds____________

Possible Time Period:
Pre-Chalcolithic____ Chalcolithic____ Early Historic_____ Medieval_____
Modern____

Disturbance:
Undisturbed_____ Light_____ Medium_____ Heavy_____
Animal_____ Trees/Plants_____ Soil removal_____ Construction_____
Other____
Comments:____
____

Present day use/occupation of the site?______________________________________
____

Description of site and surrounding area:

Location of site datum:
Description of work done at the site: **# of units collected:**

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Artifacts found (preliminary impressions):

Comments:

	Not Present	Low Density	Medium Density	High Density
Pottery				
Modern				
CRW				
BRW				
Thin-slipped Red				
Jorwe				
Other				

	Not Present	Low Density	Medium Density	High Density
Lithics				
Flakes				
Blade Cores				
Blades				
Microliths				
Shatter				
Quartz				
Chert				
Other				

Other	Not Present	Low Density	Medium Density	High Density
Slag				
Vitrified Sand				
Metal				
Beads				
Figurines				
Groundstone				
Hammerstones				
Slingballs				
Other 1				
Other 2				

Other Comments:

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Appendix 4—Illustrations of Lithics

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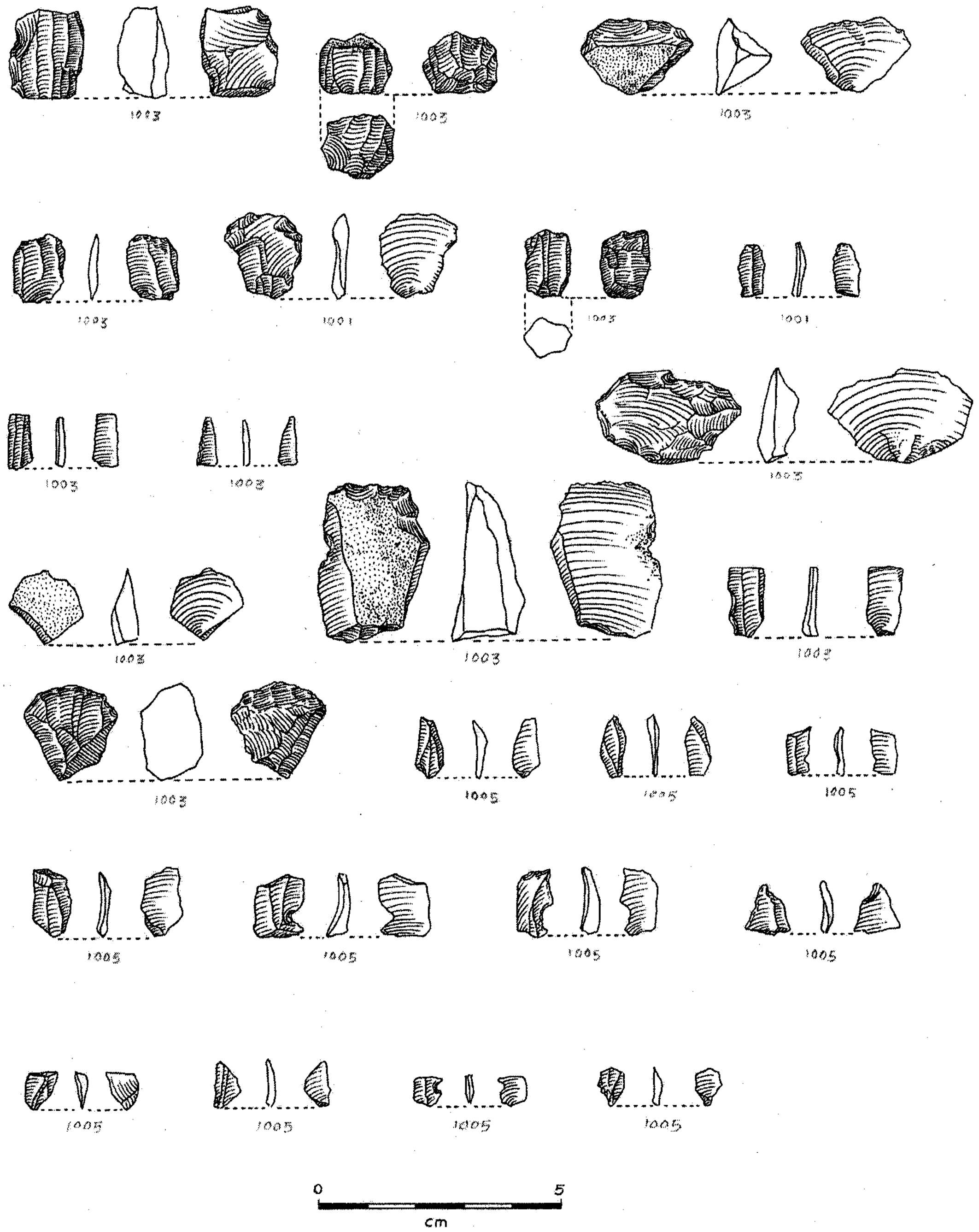
Bagor



Illustrations by Bharat Dighe, Devadatta Phule,a dn Shrikant Pradhan

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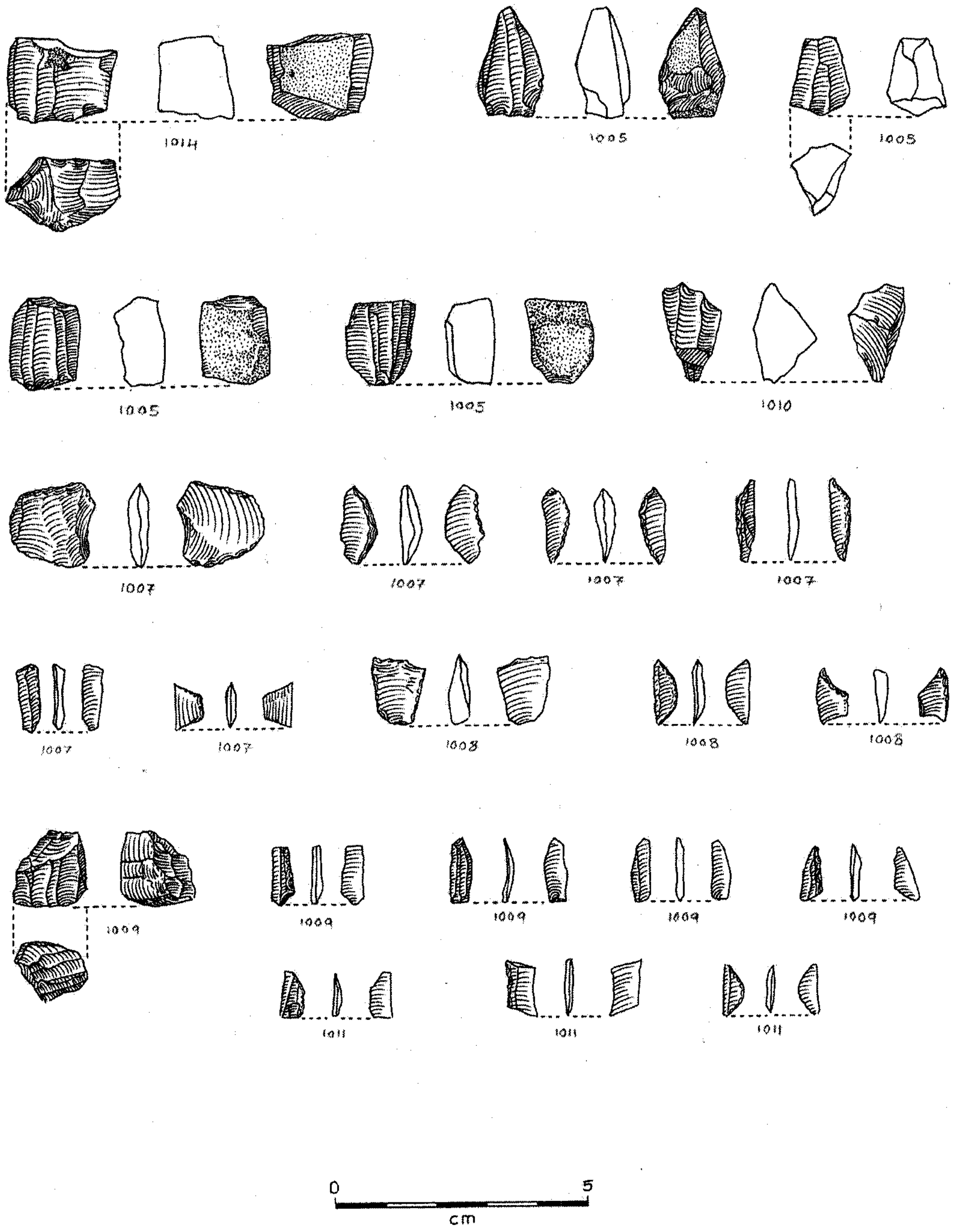
Bagor



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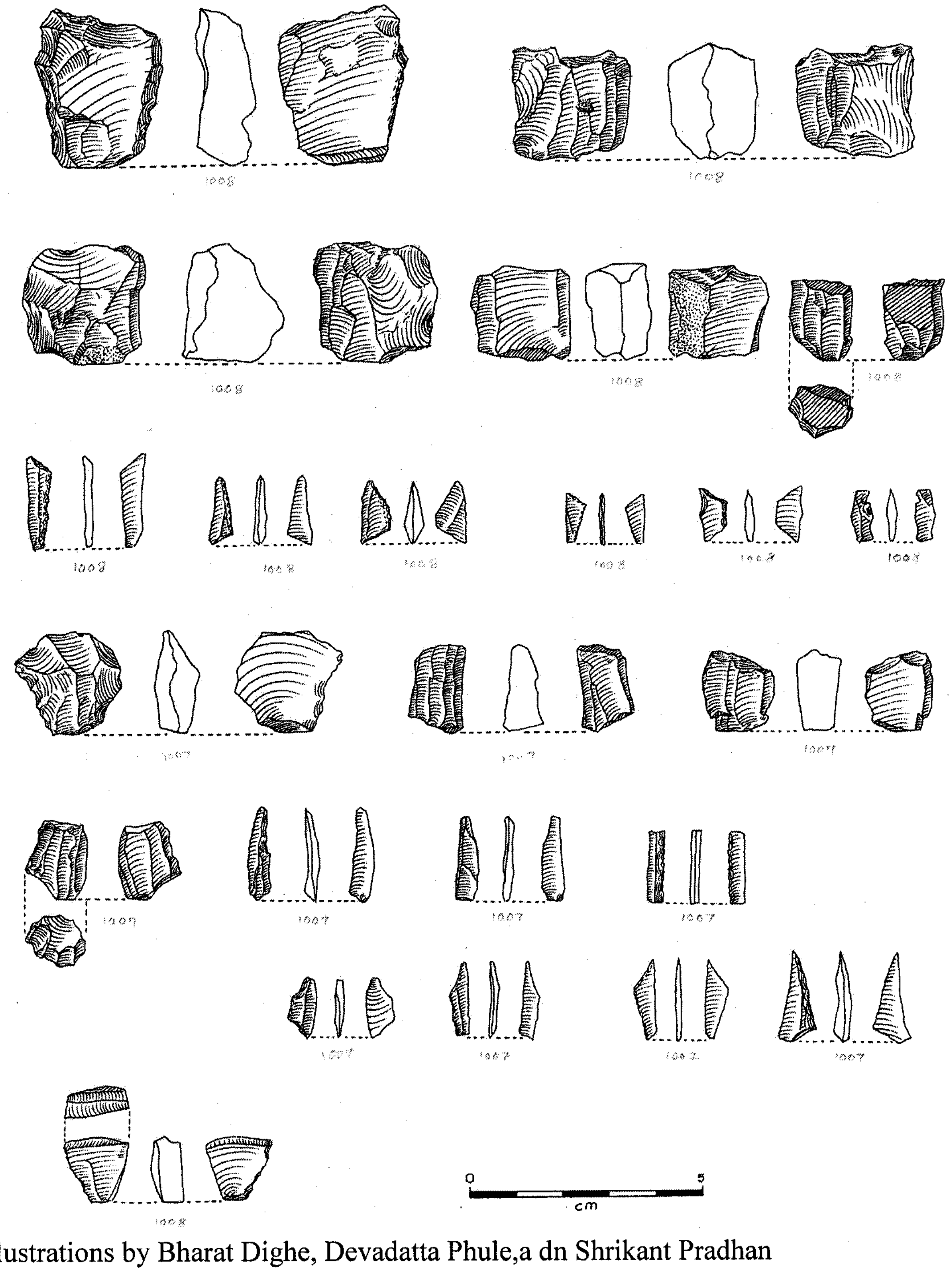
Bagor



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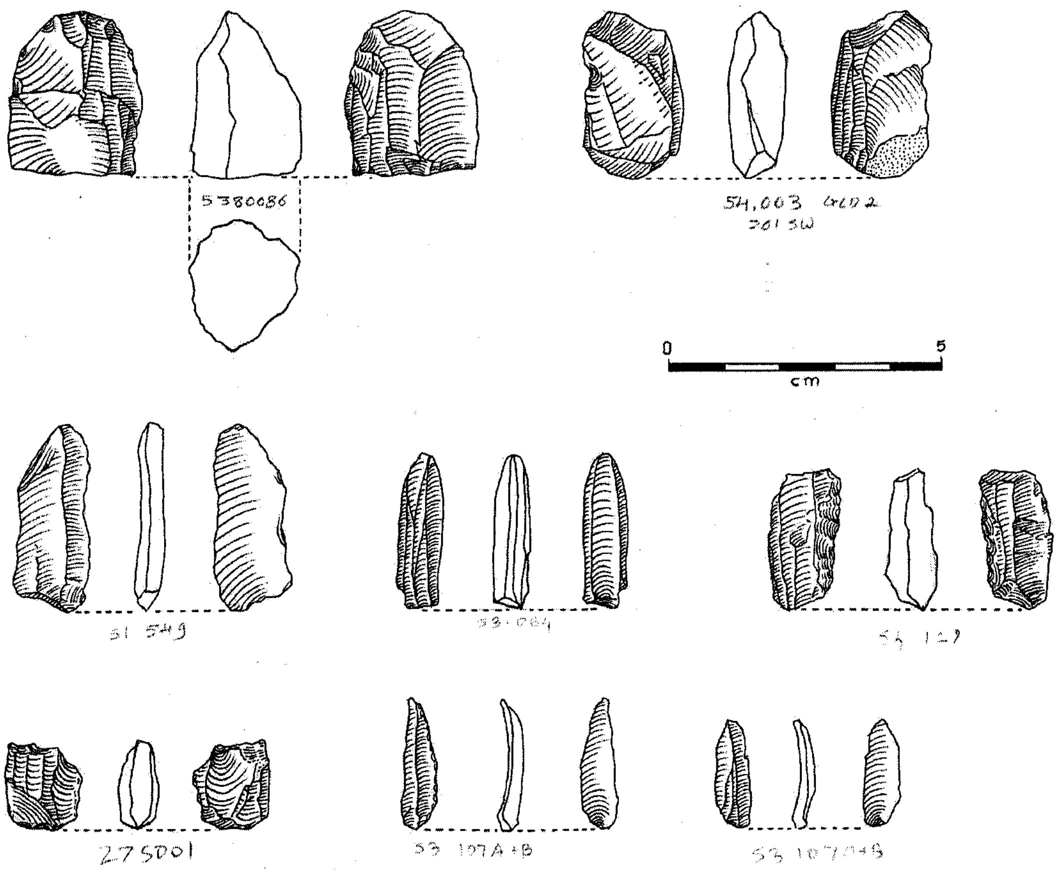
Gilund



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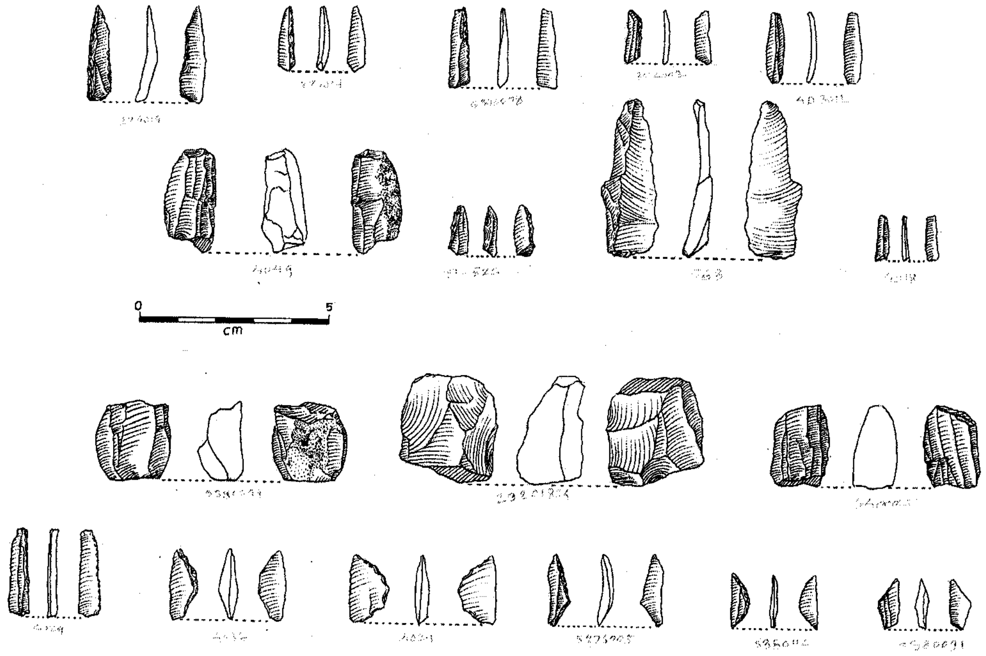
Gilund



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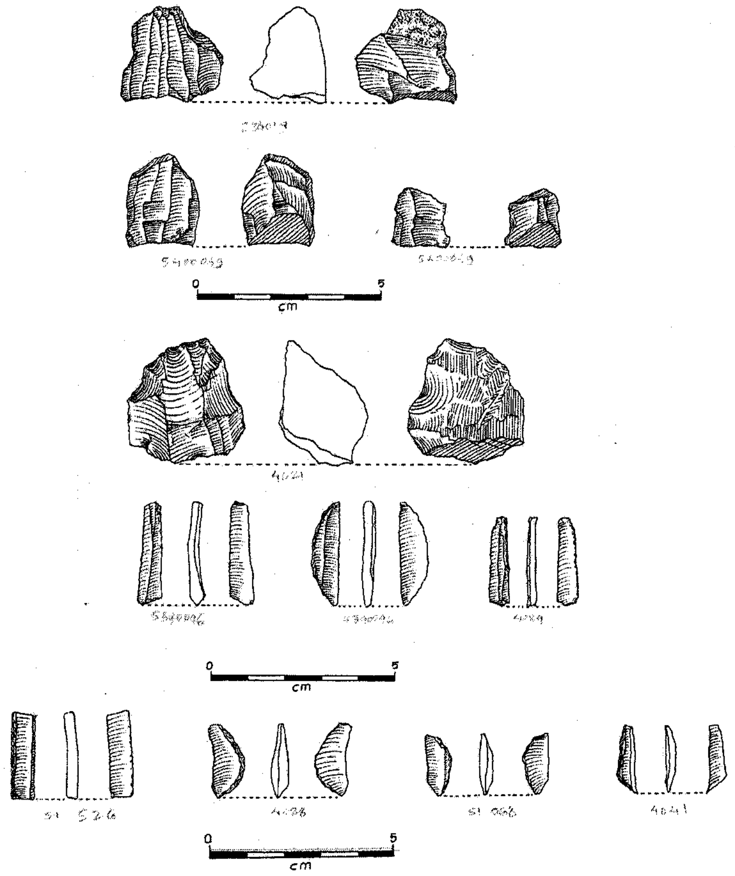
Gilund



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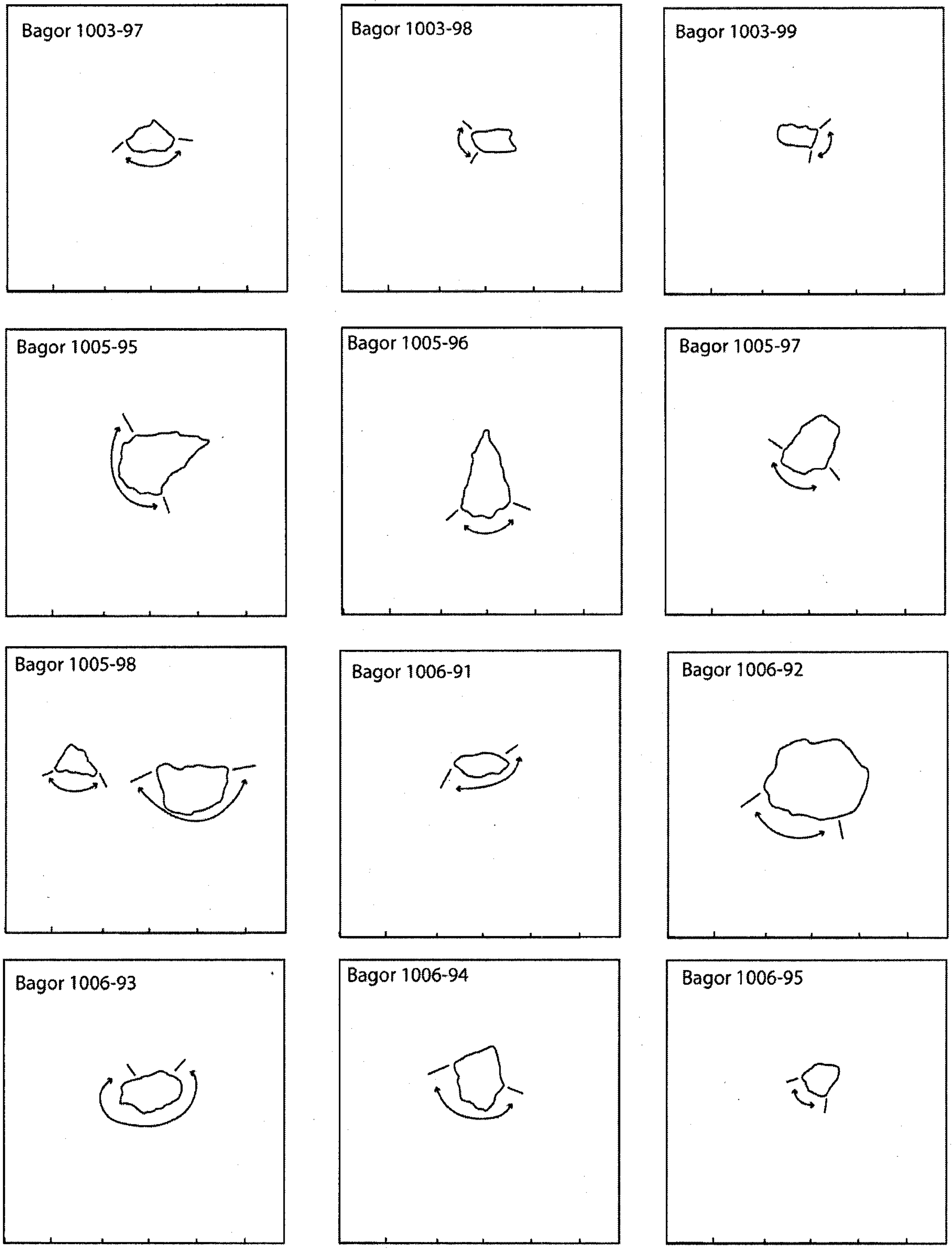
Core Platform Illustrations
(Arrows indicate area of blade removal)



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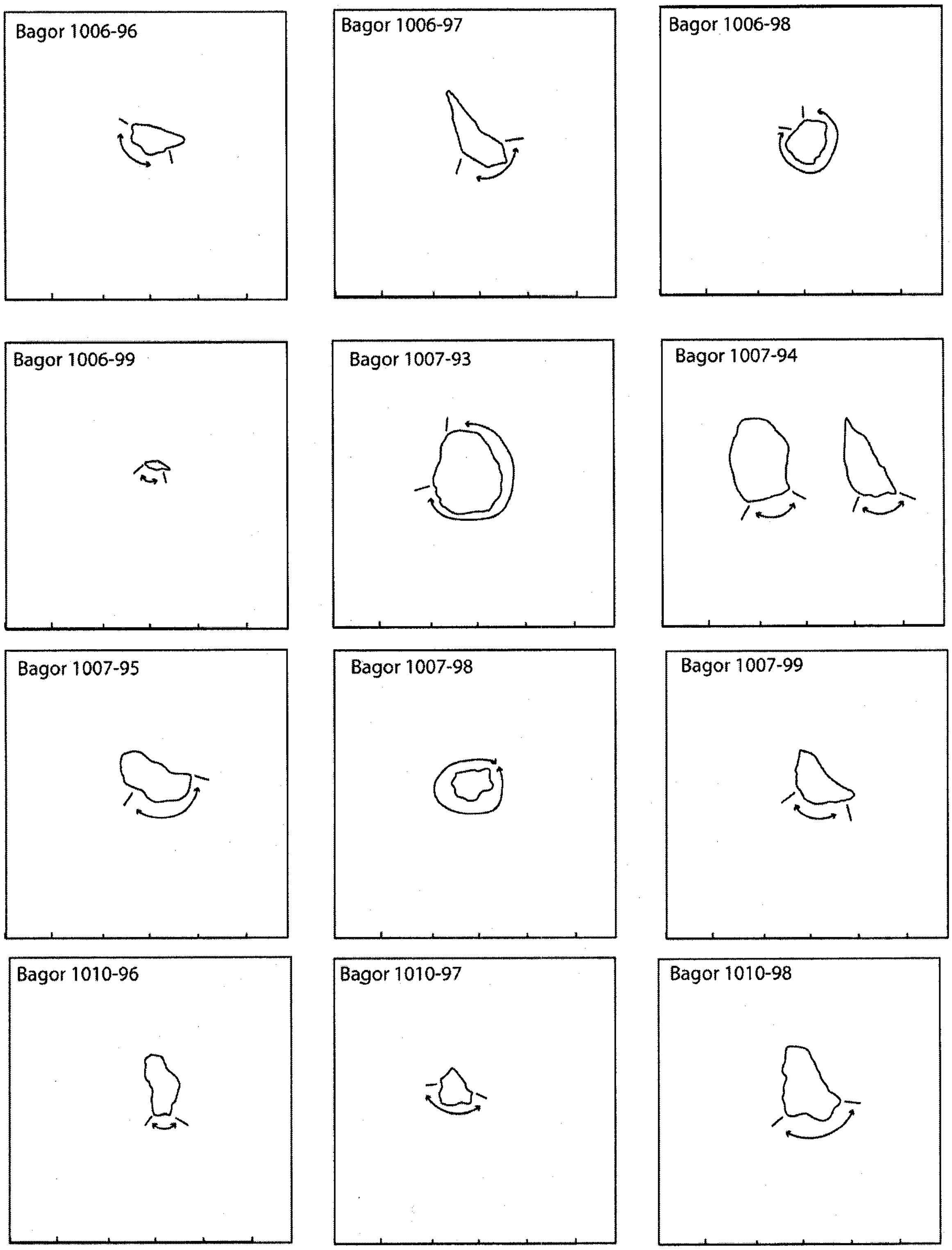

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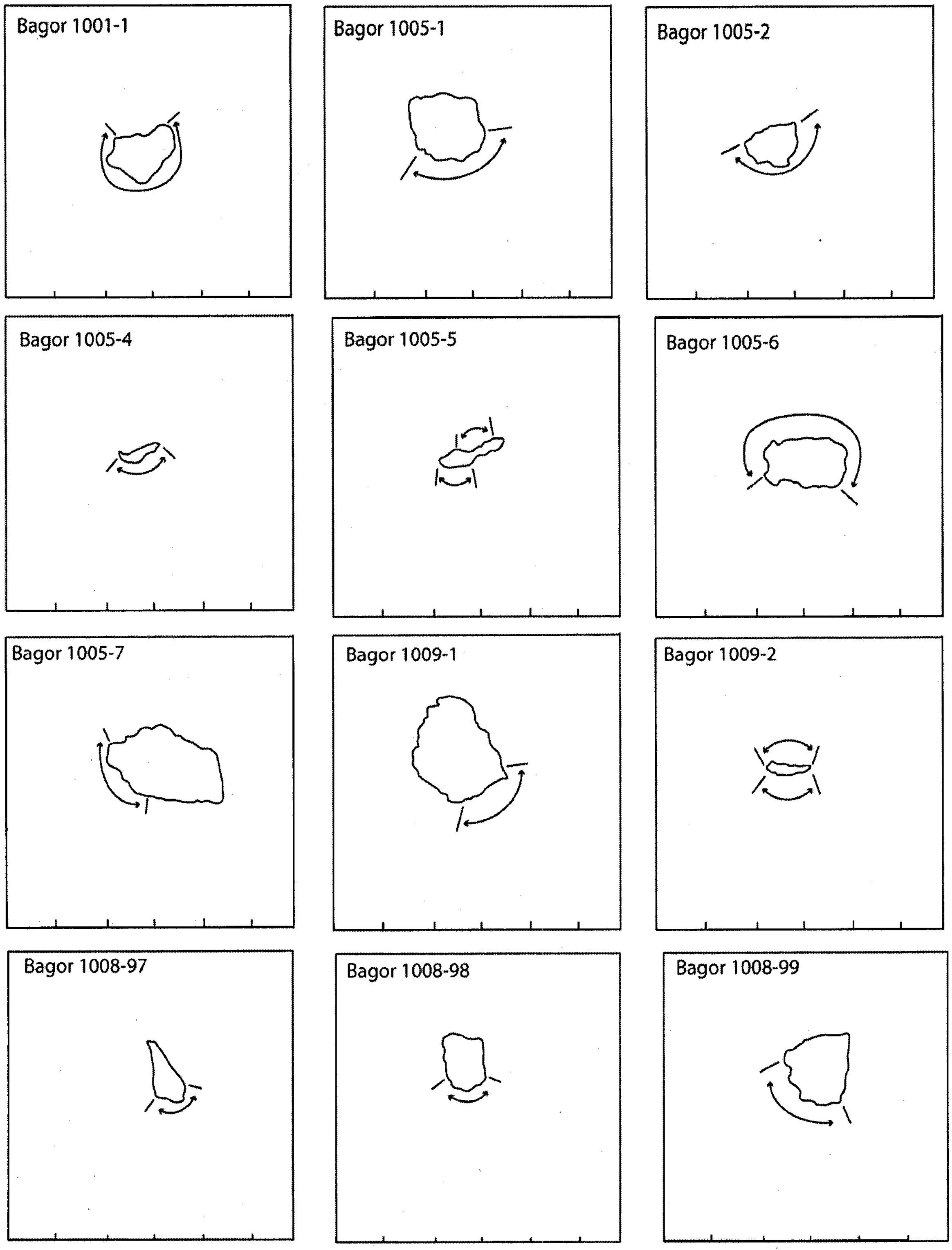

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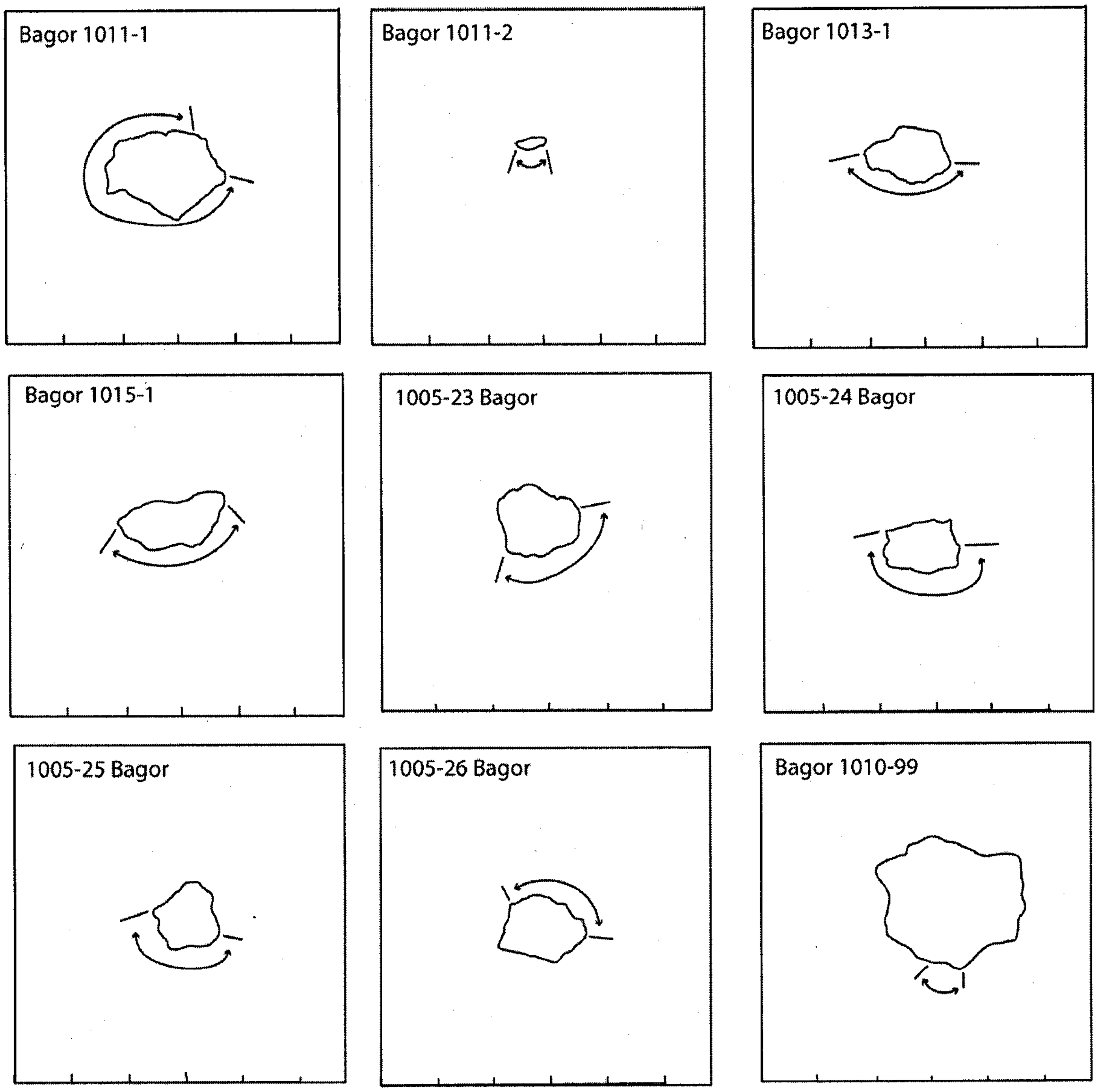

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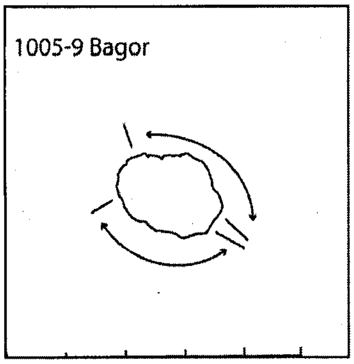

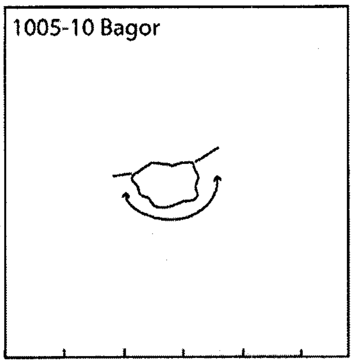

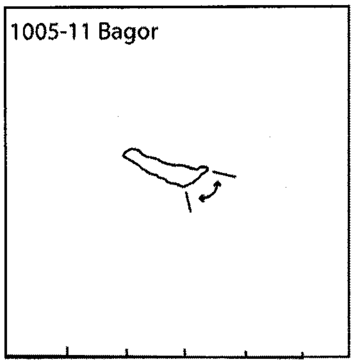

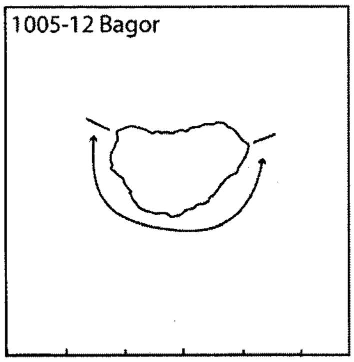

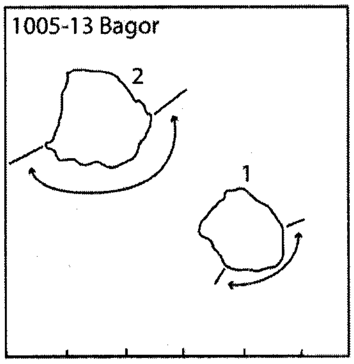

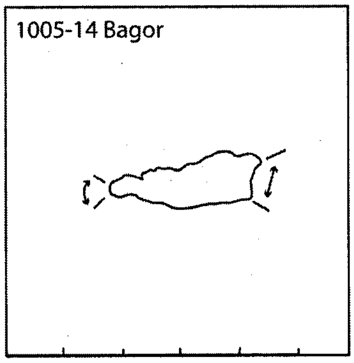

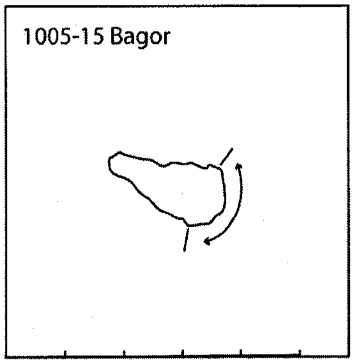

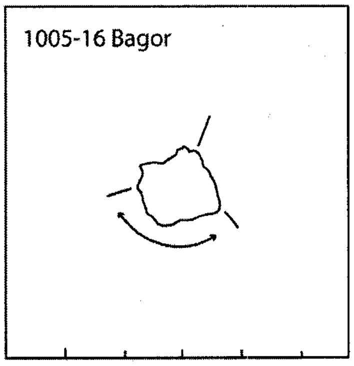

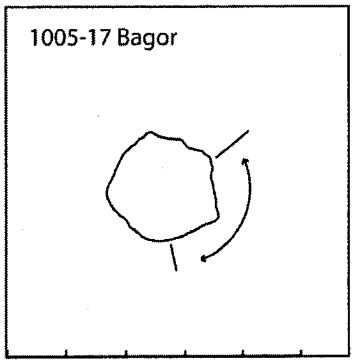

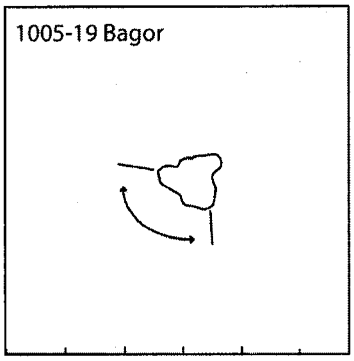

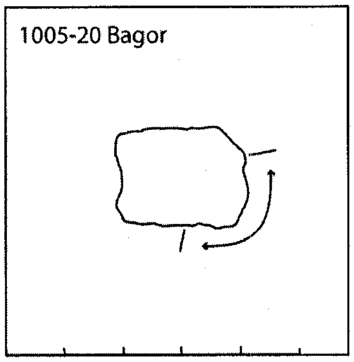

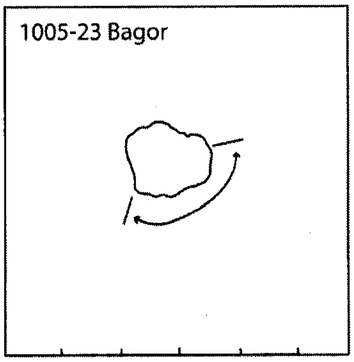

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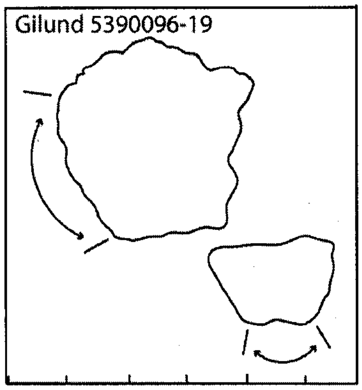

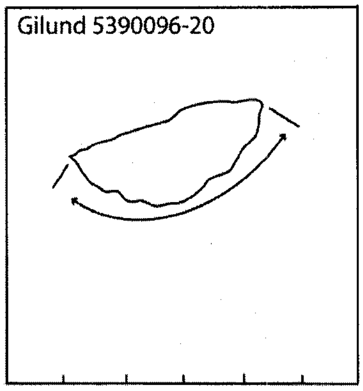

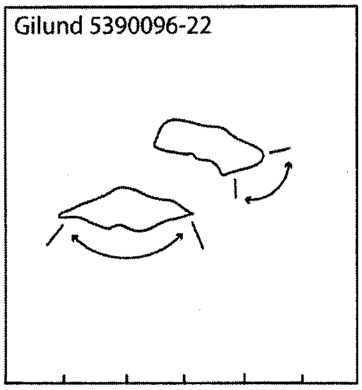

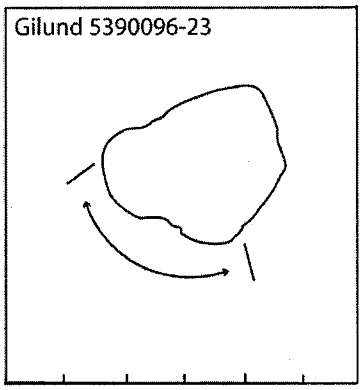

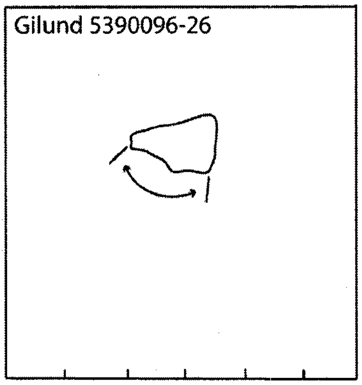

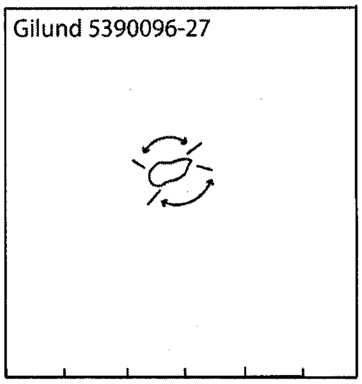

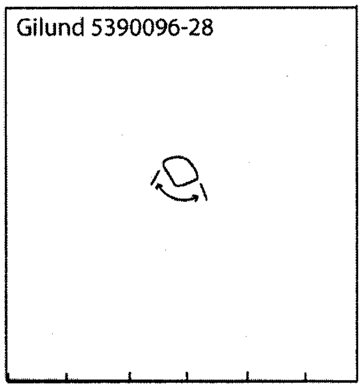

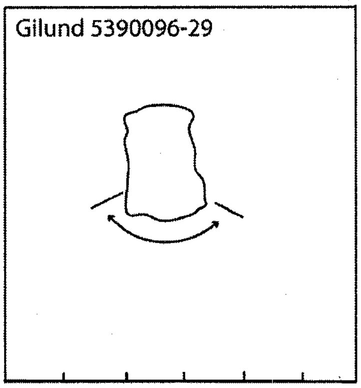

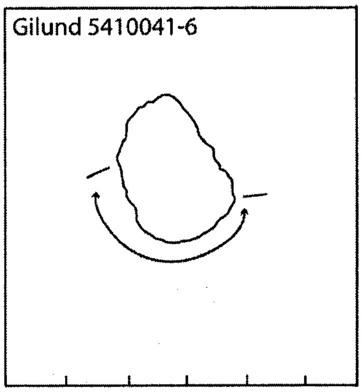

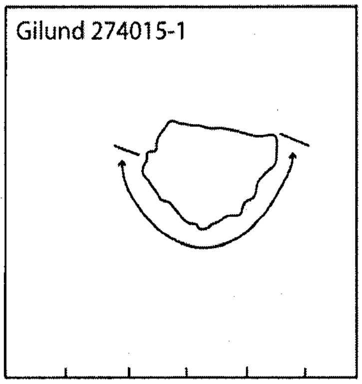

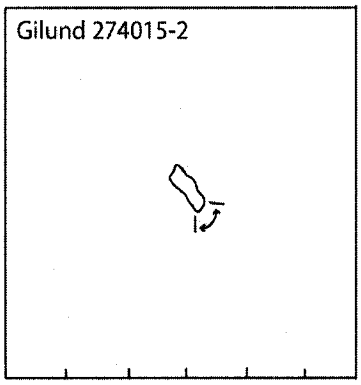

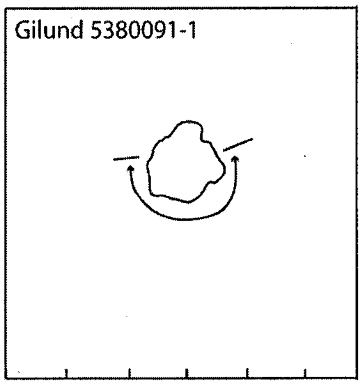

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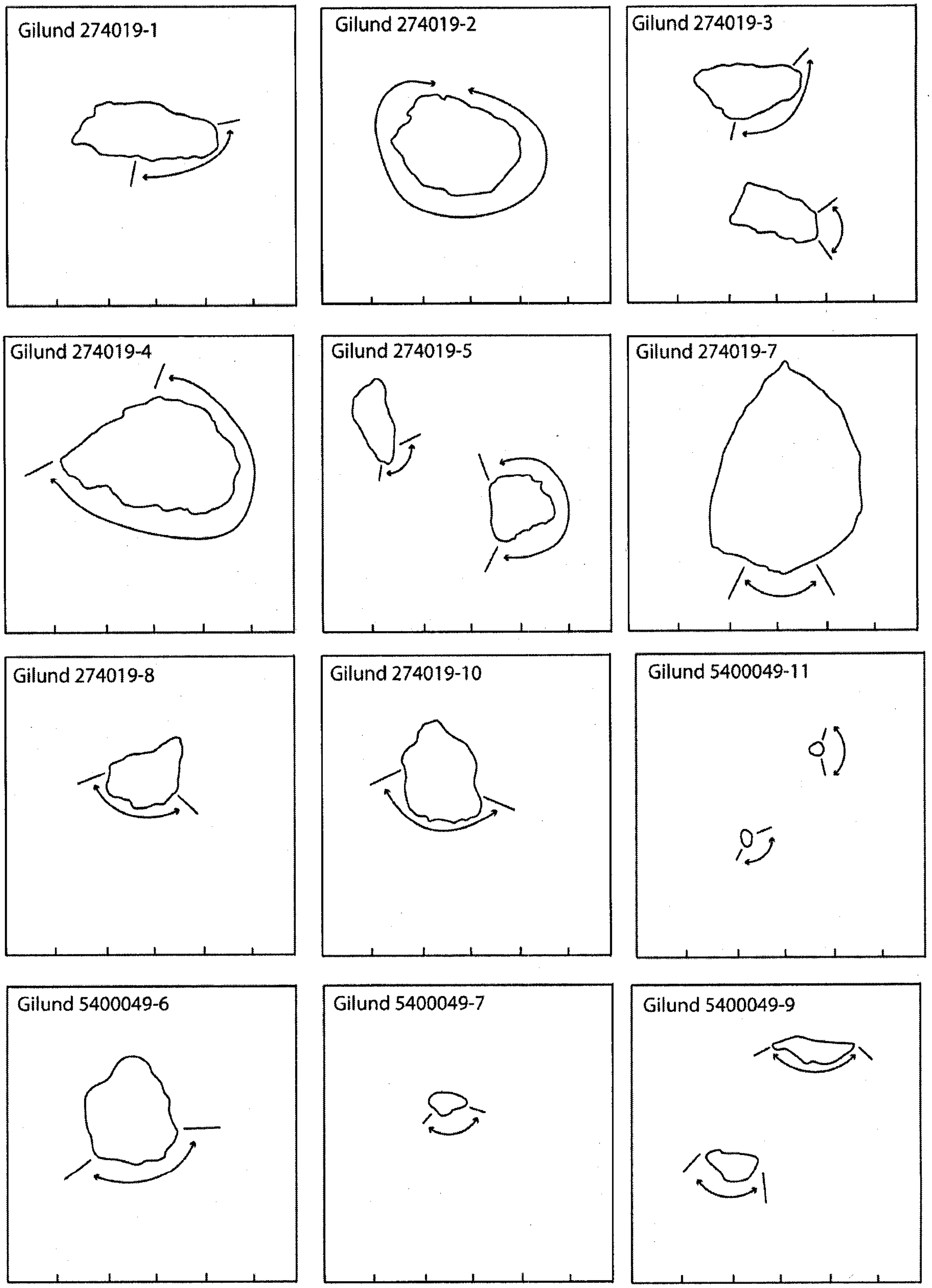

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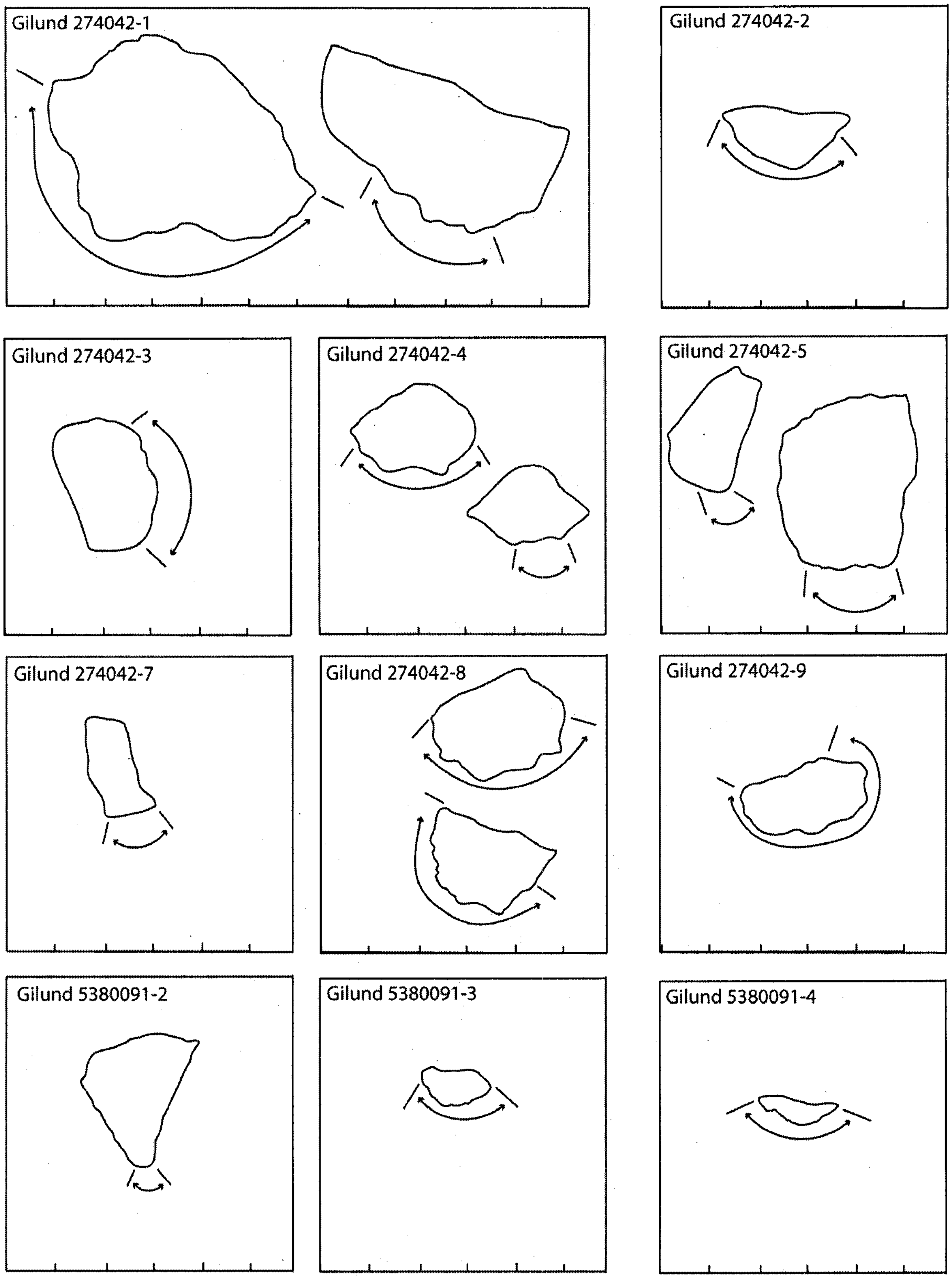

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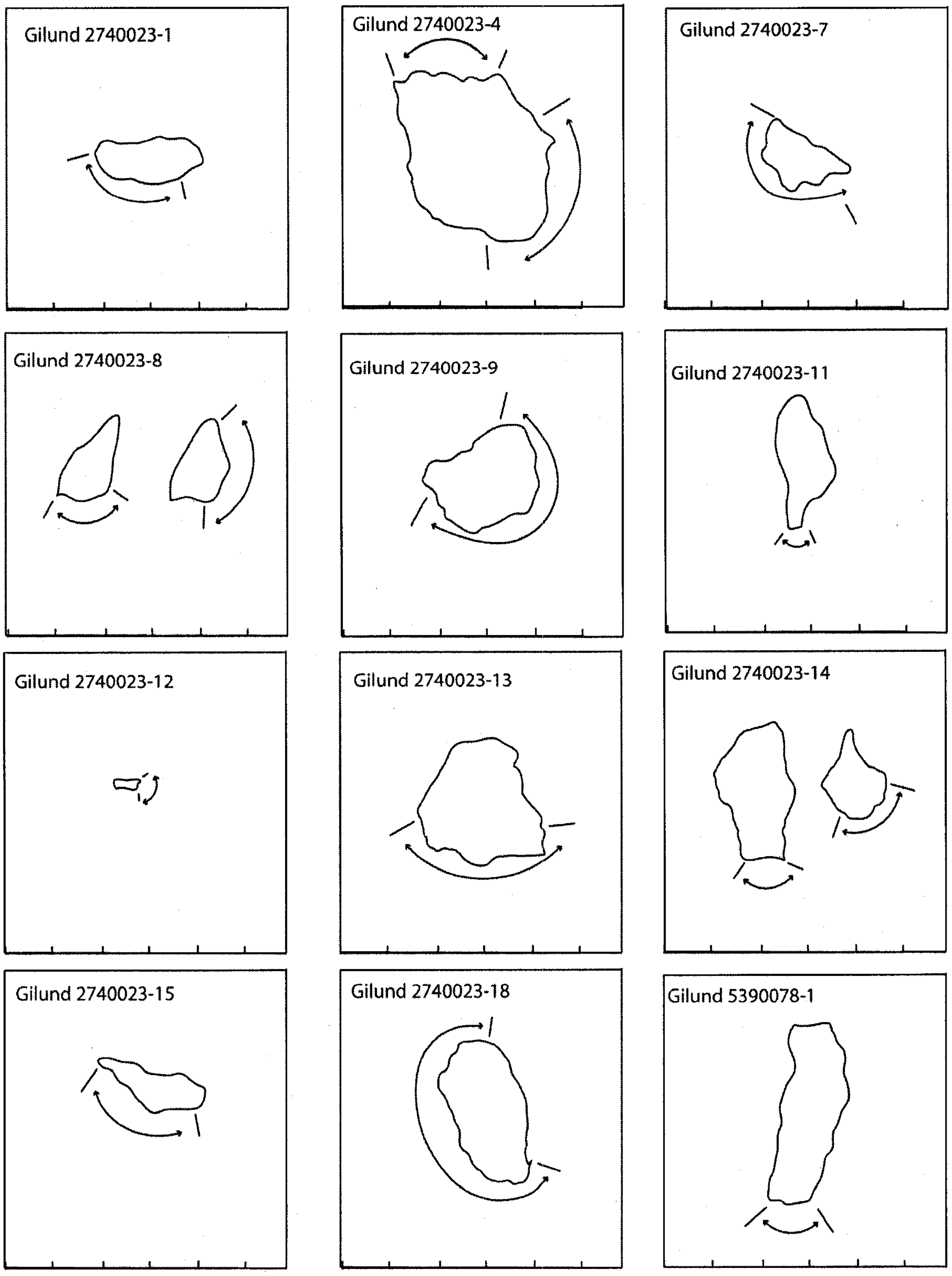

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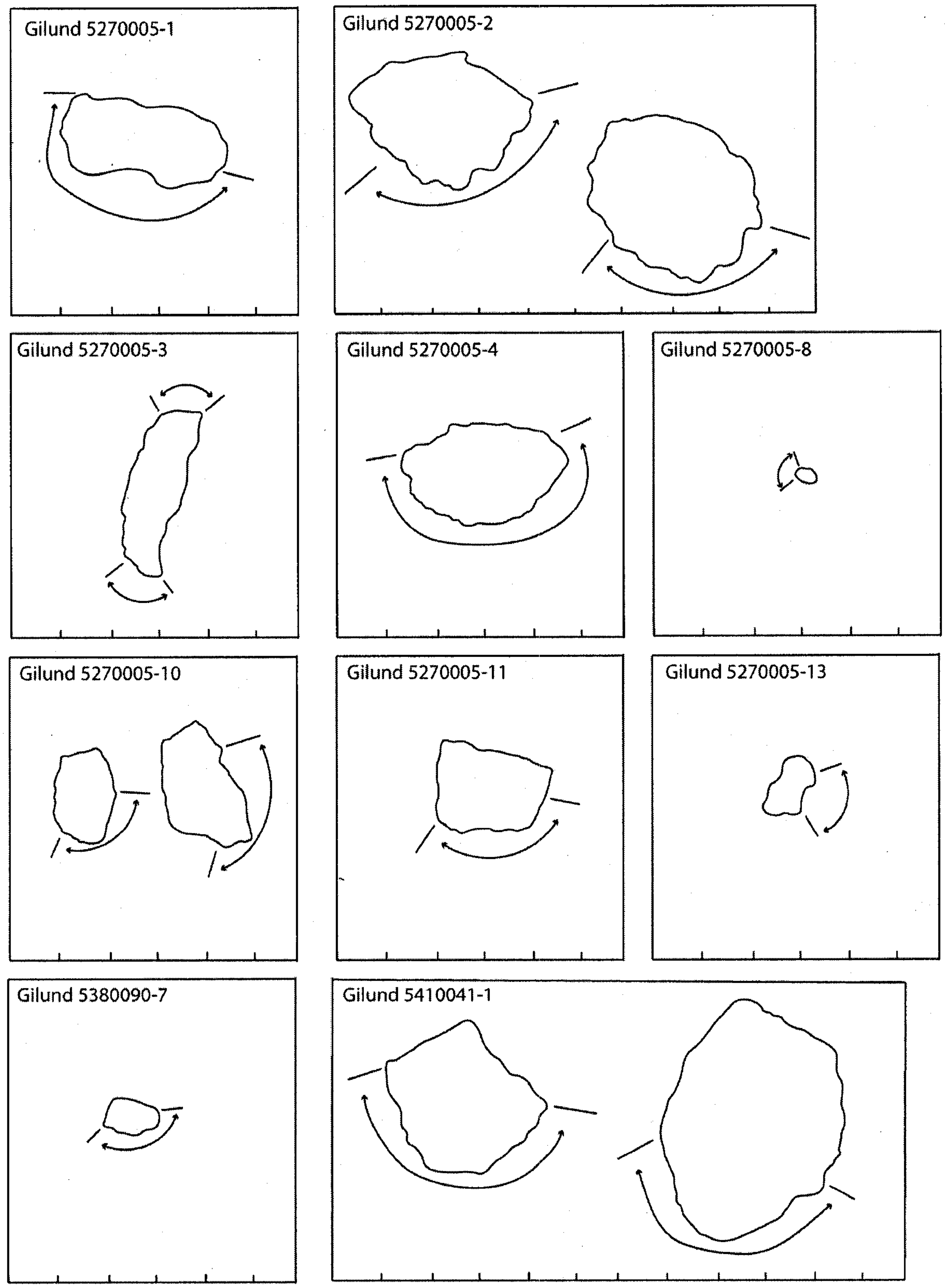

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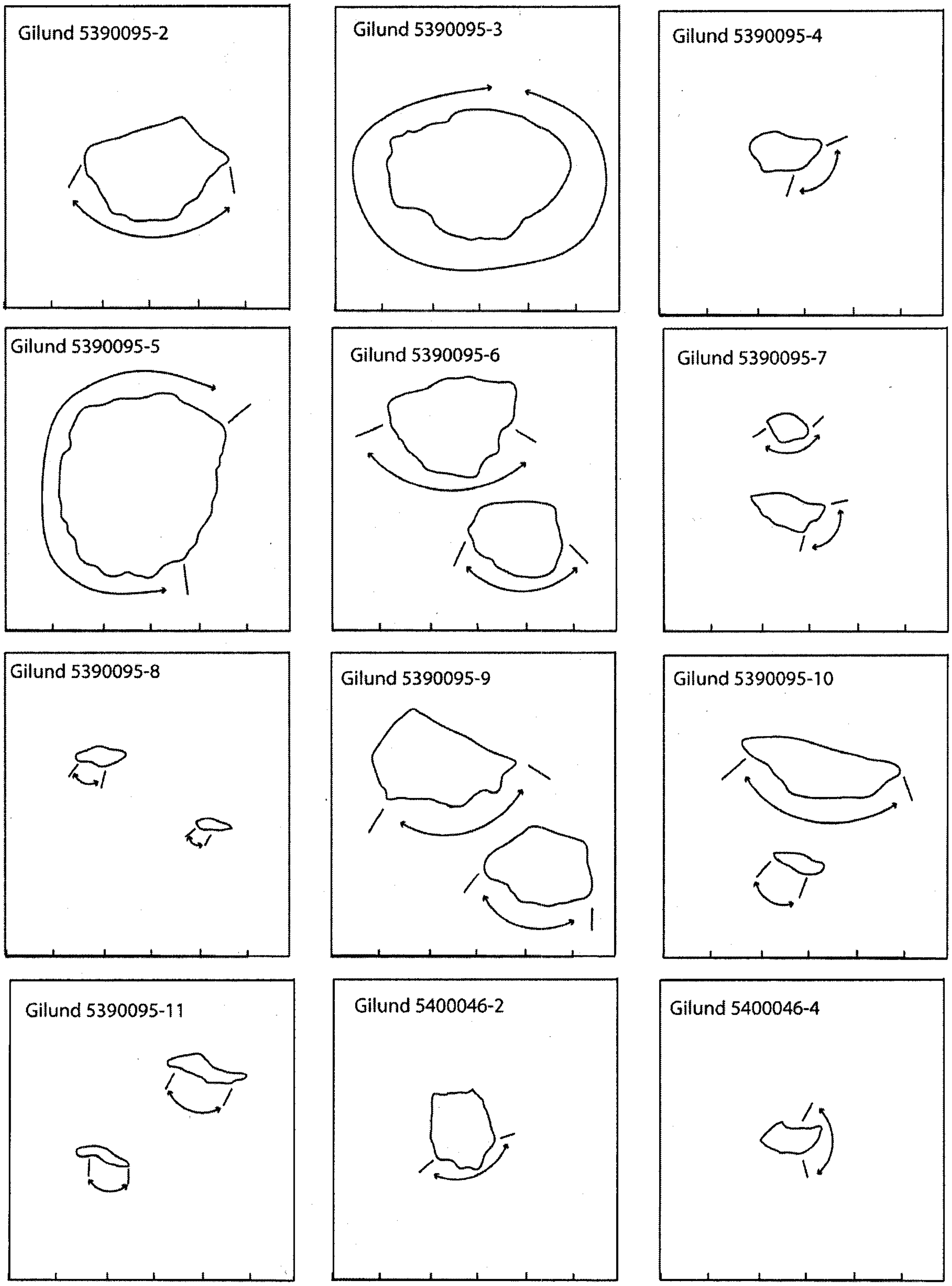

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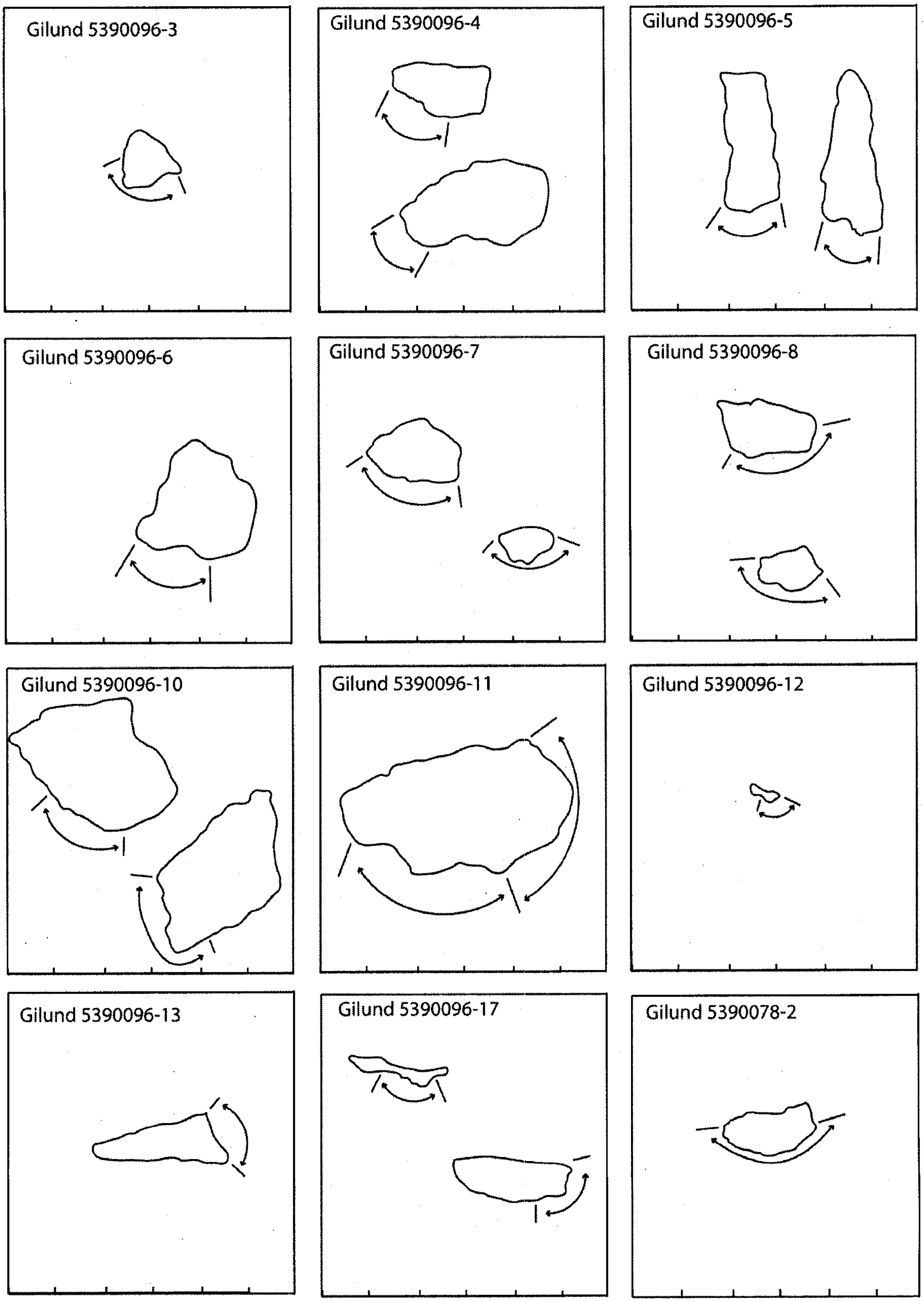

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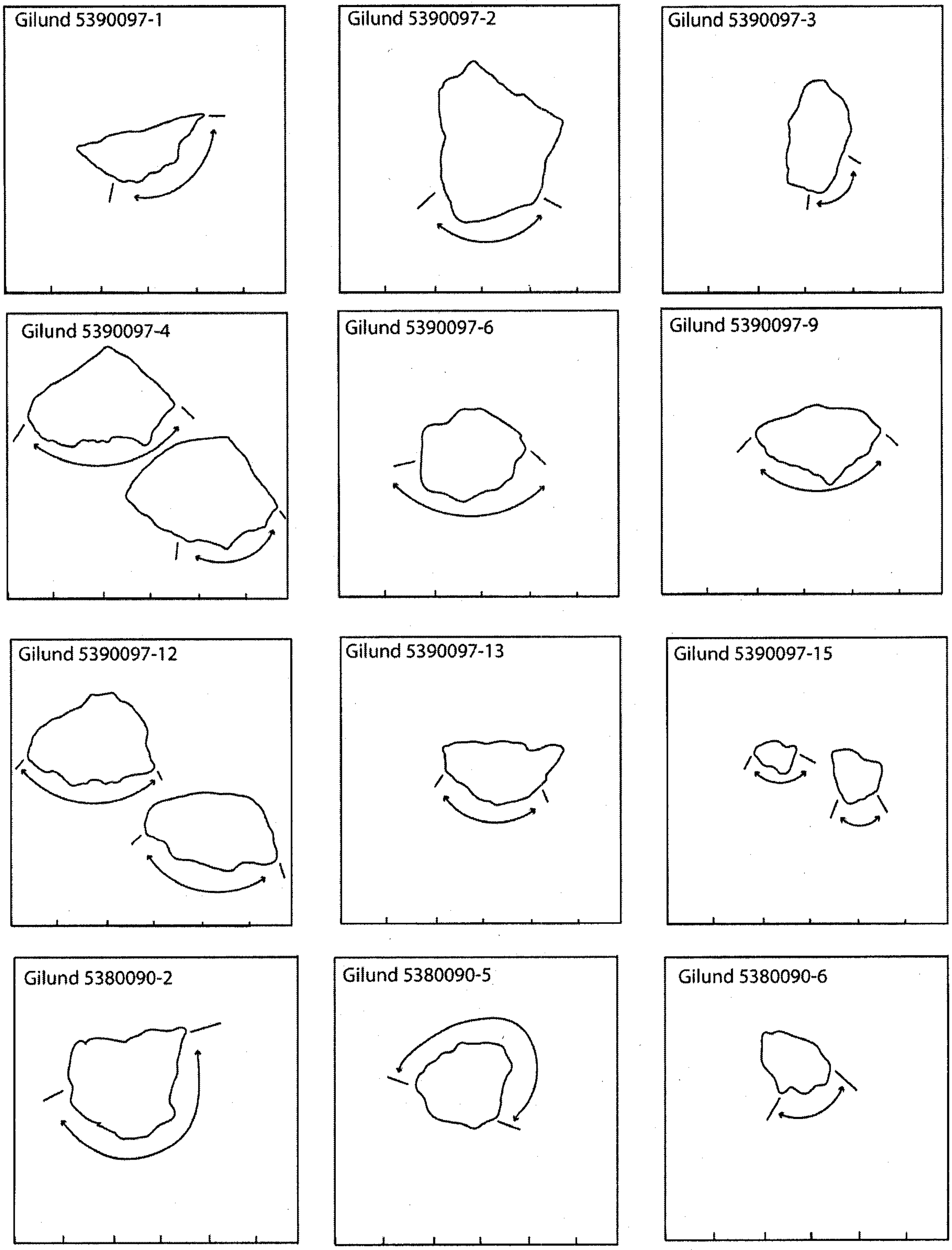

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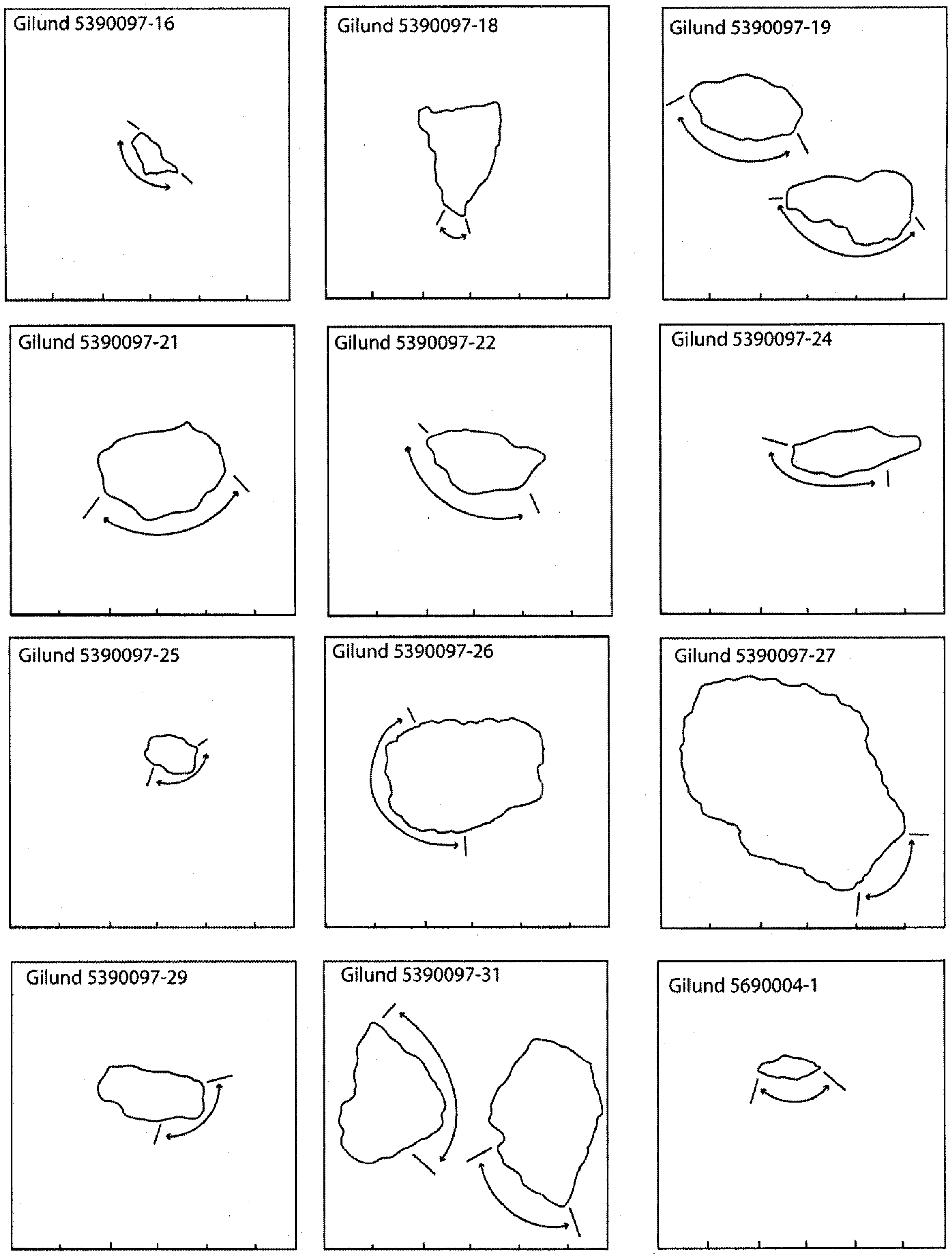

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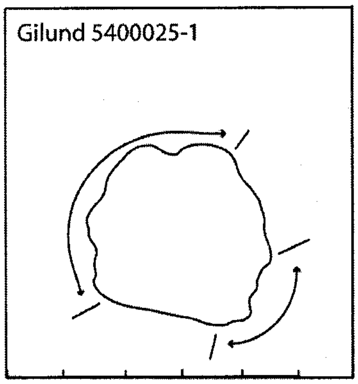

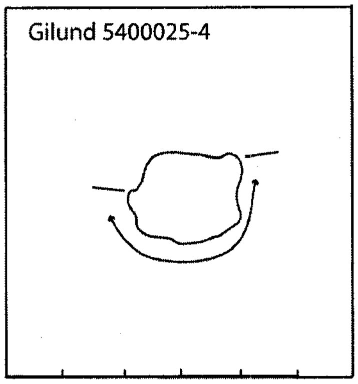

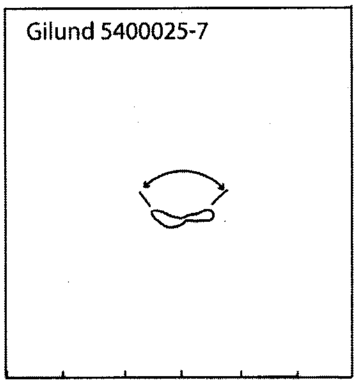

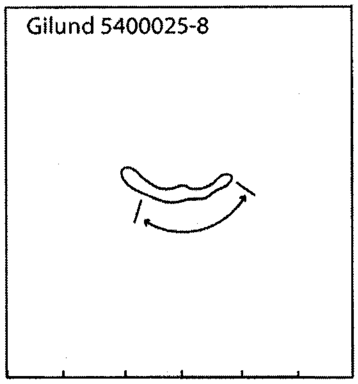

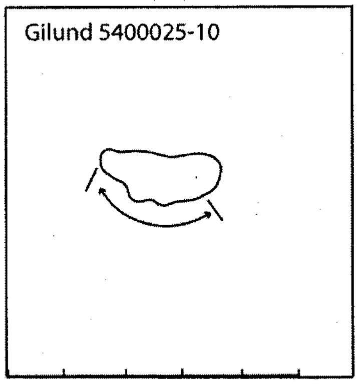

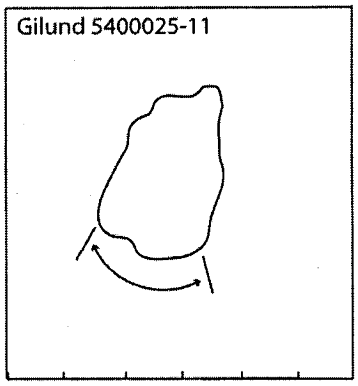

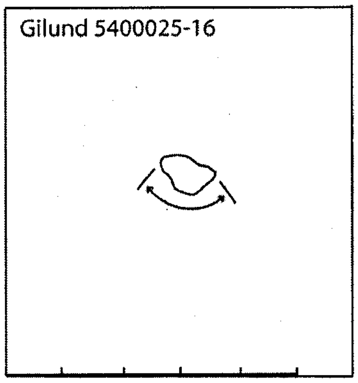

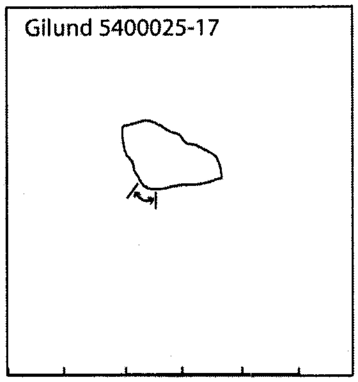

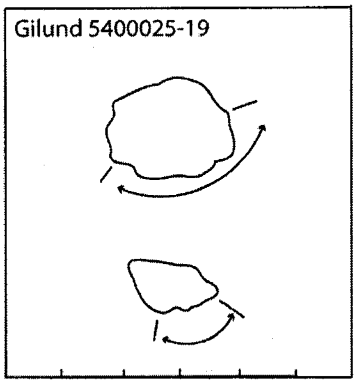

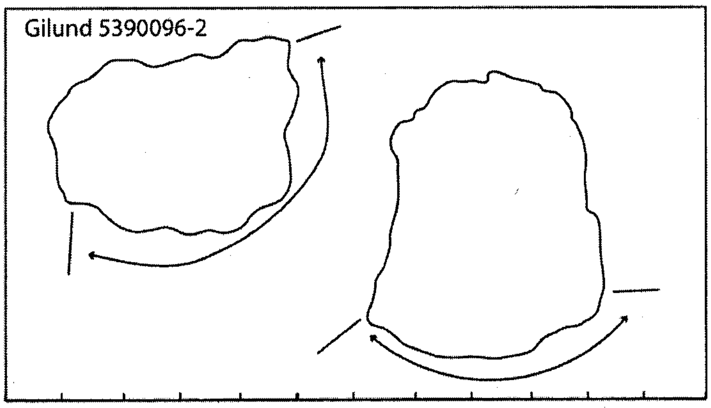

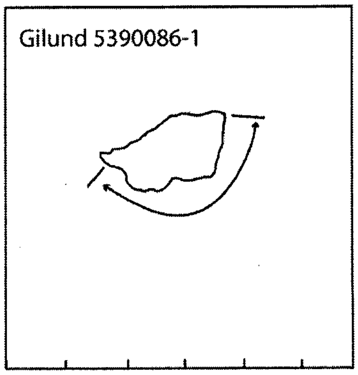

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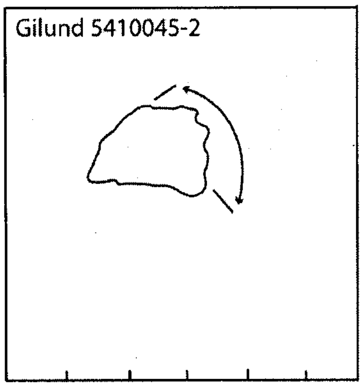

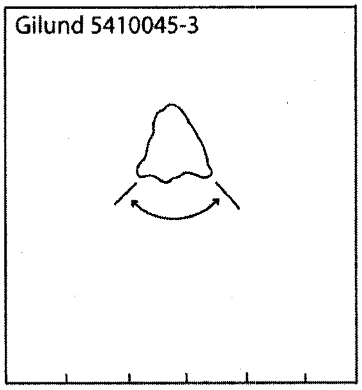

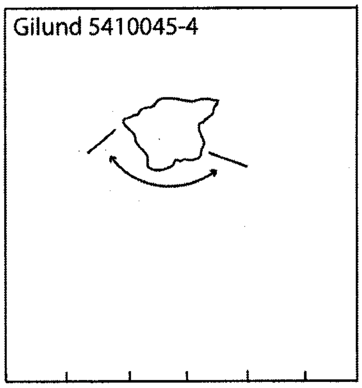

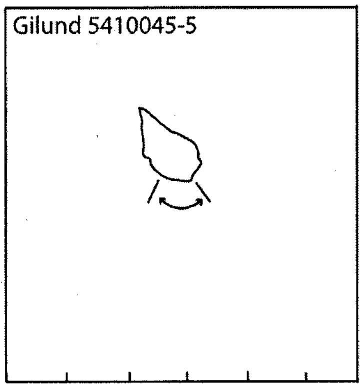

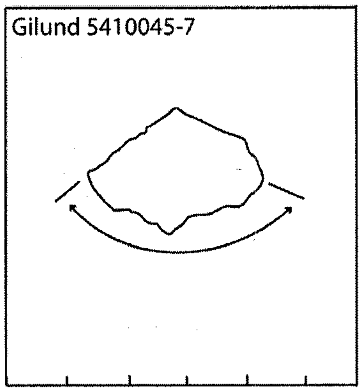

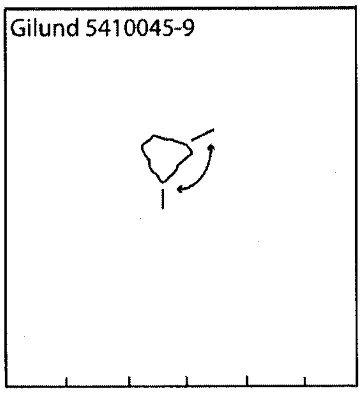

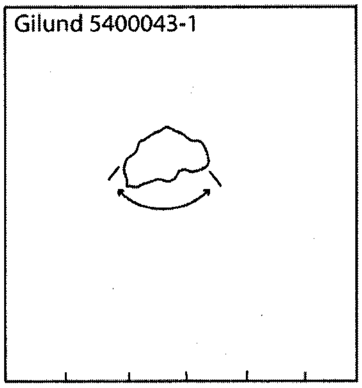

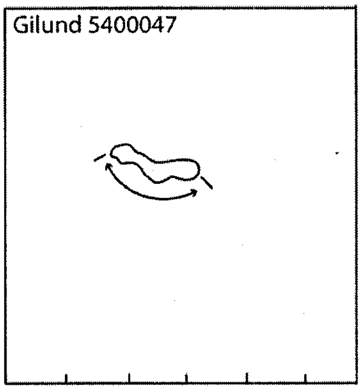

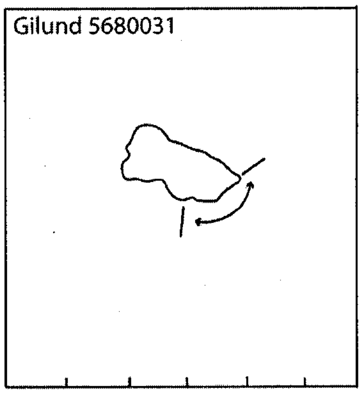

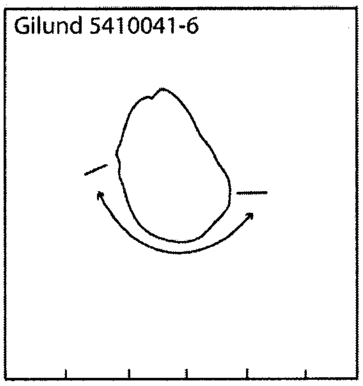

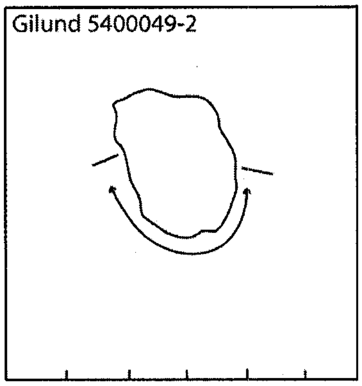

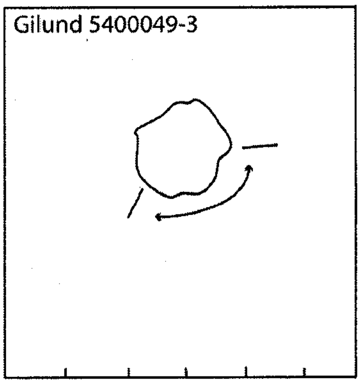

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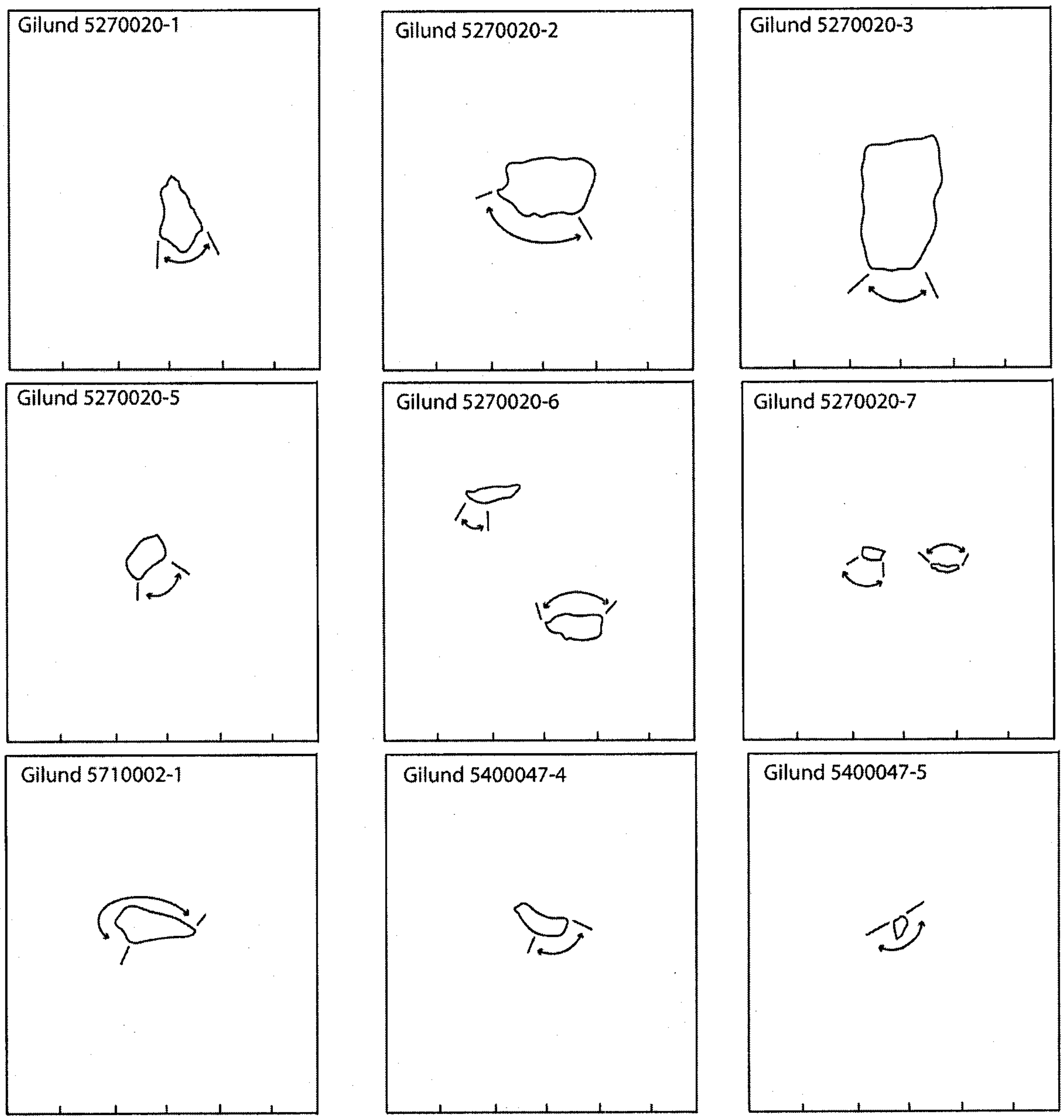

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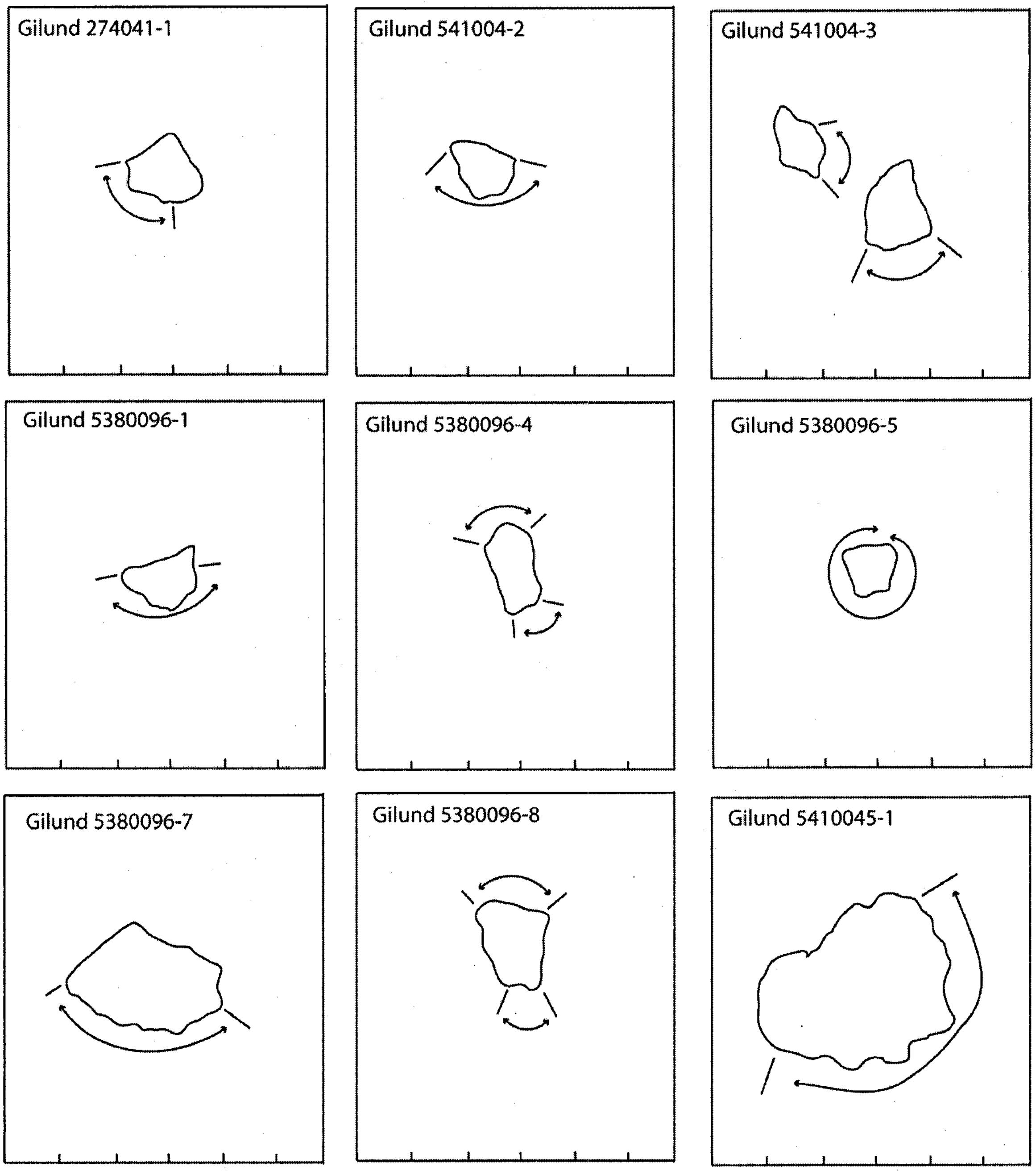

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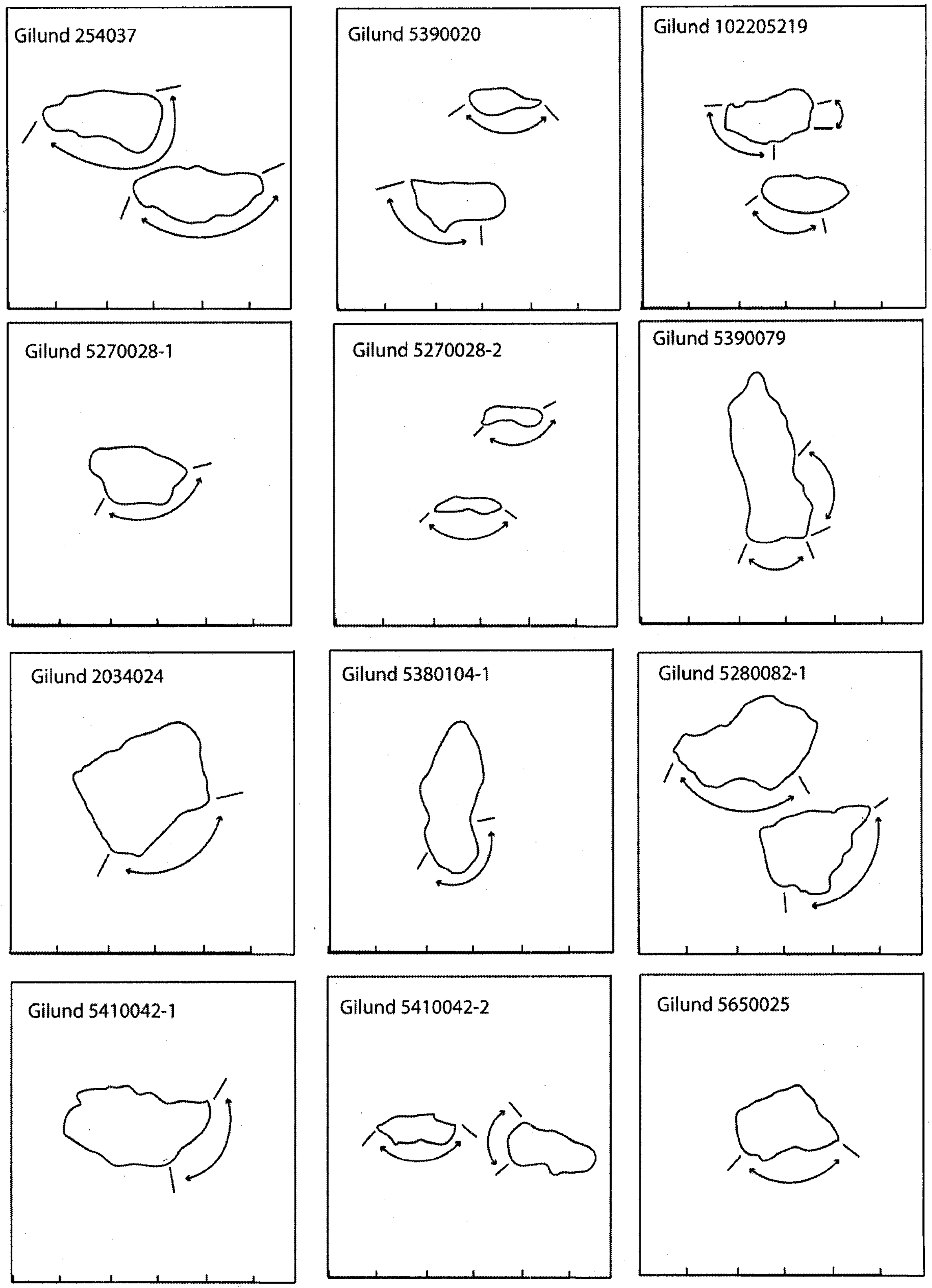

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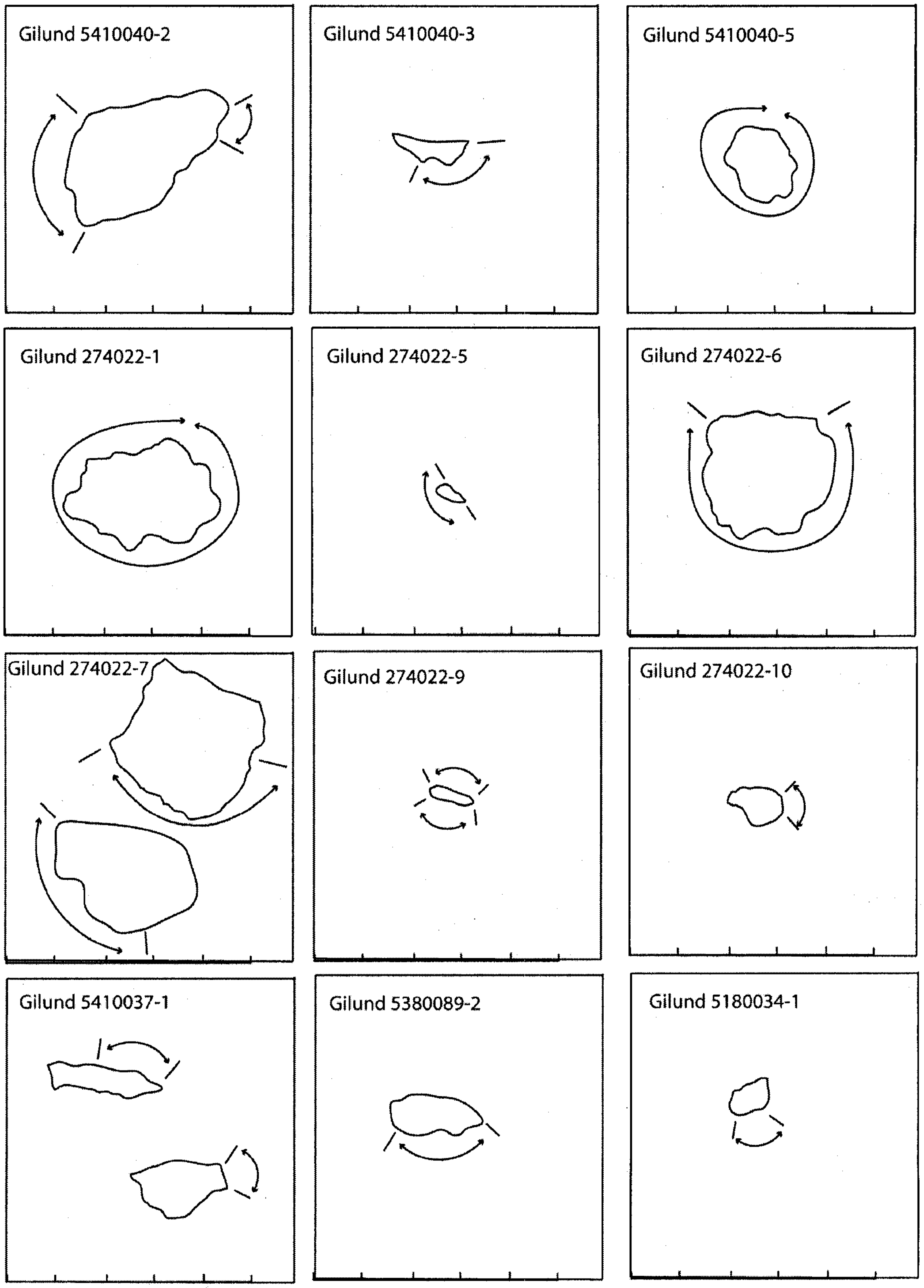

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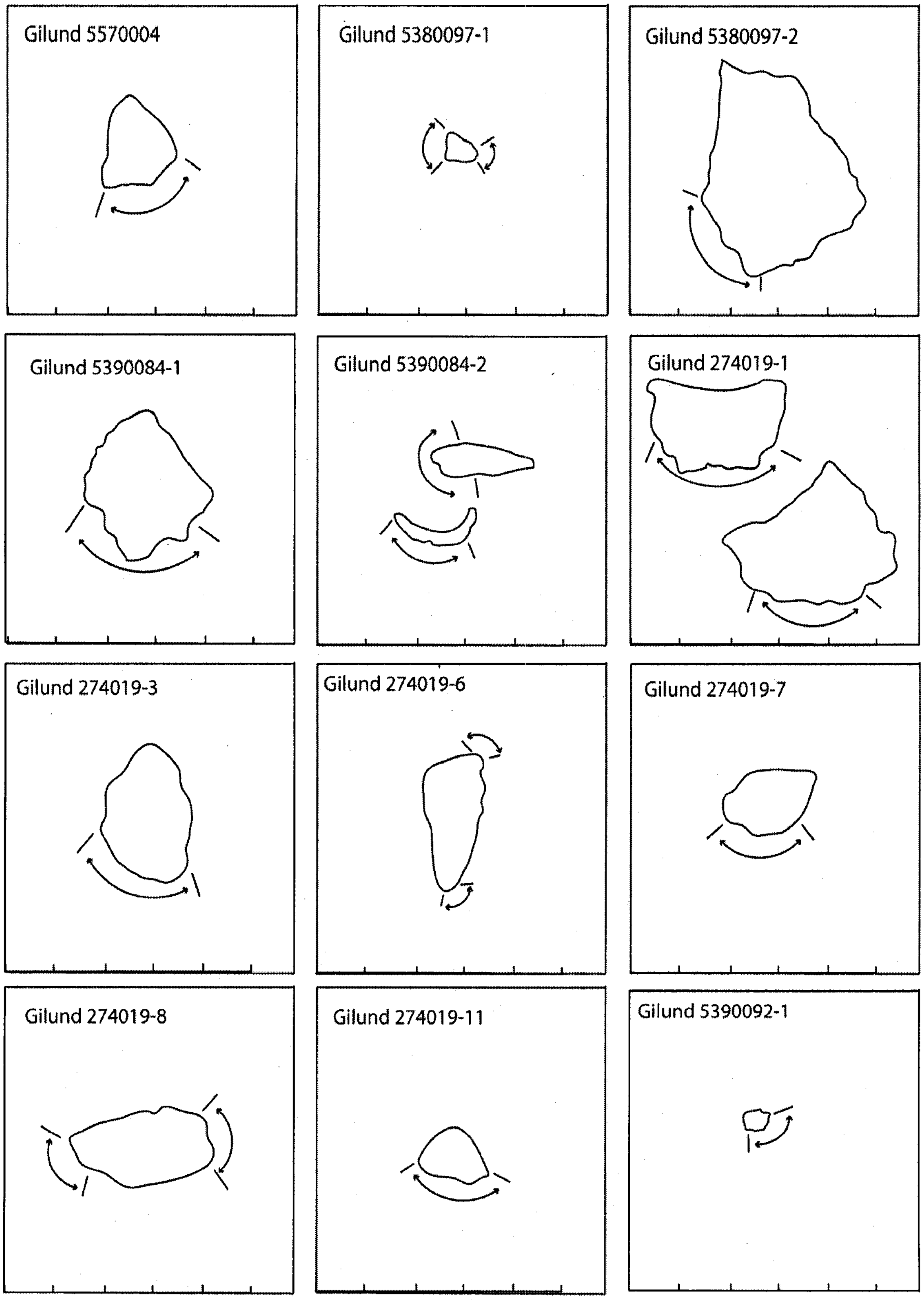

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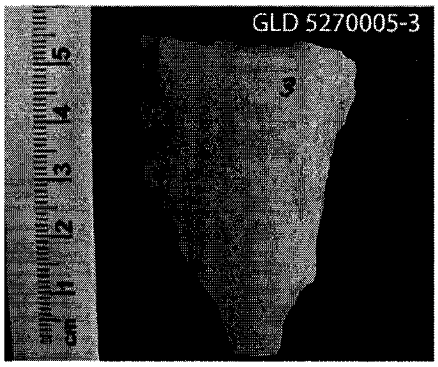
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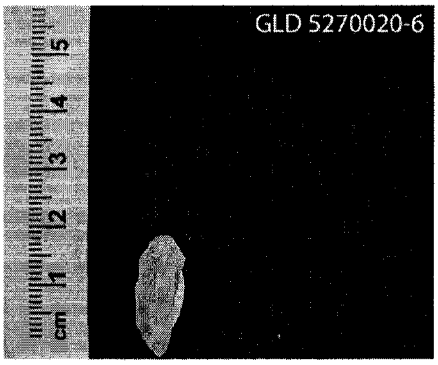
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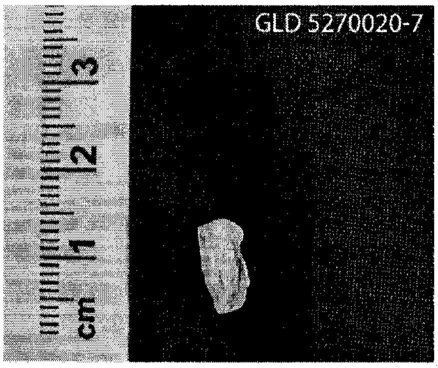
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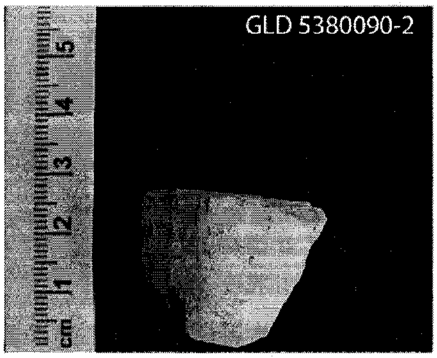
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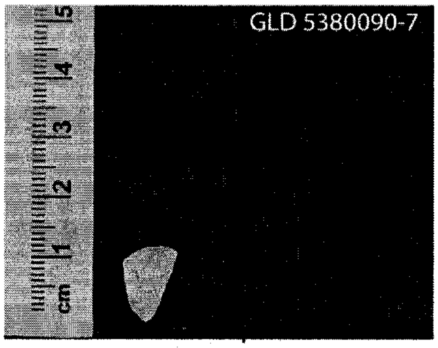
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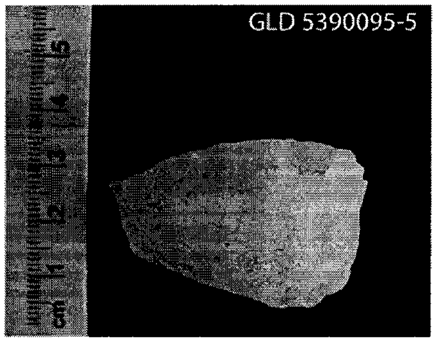
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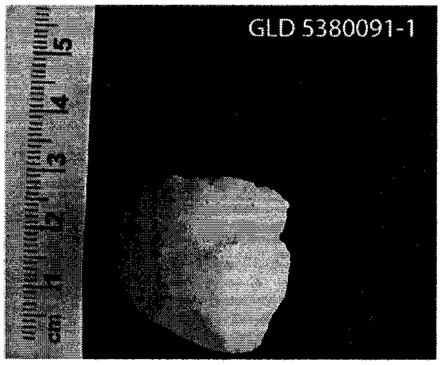
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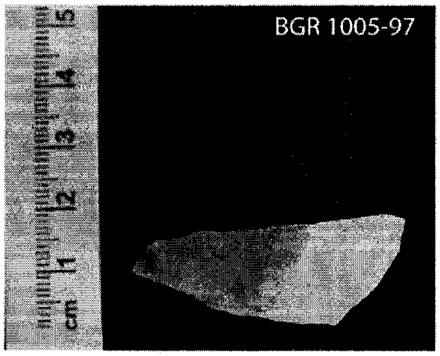
BGR 1005-97

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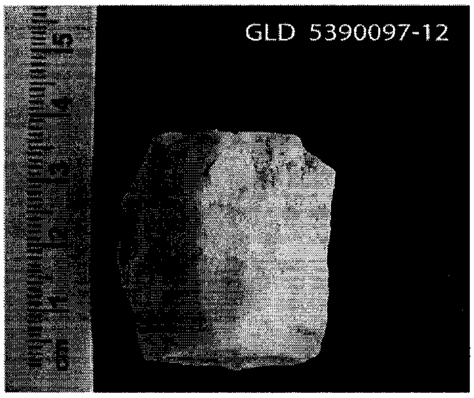

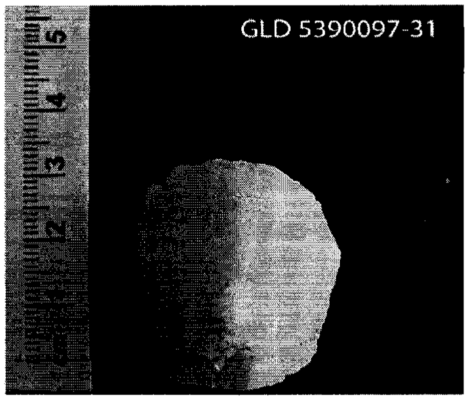

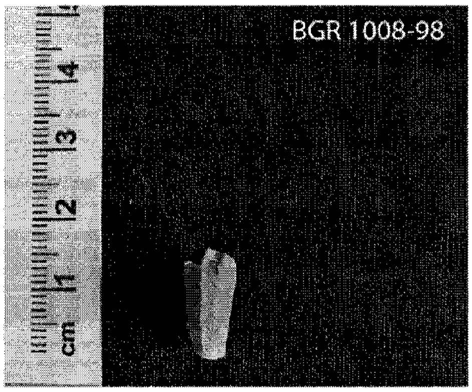

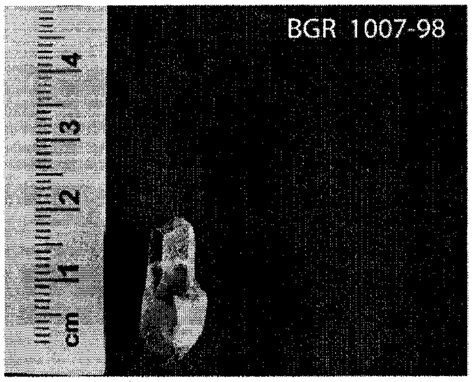

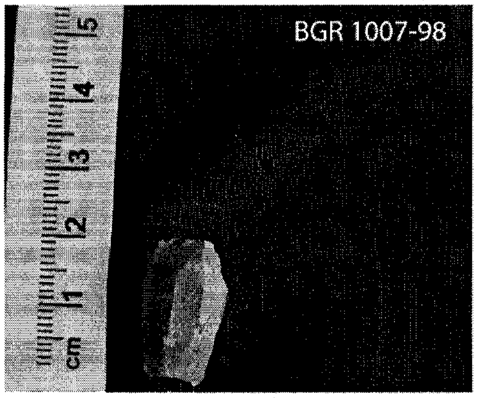

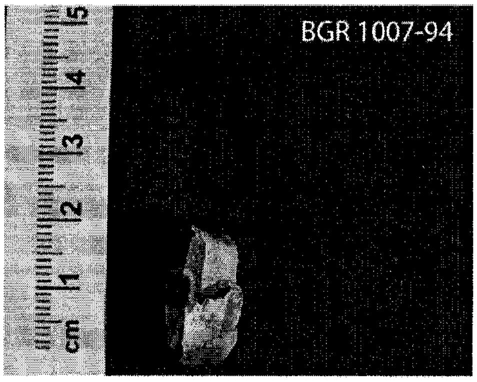

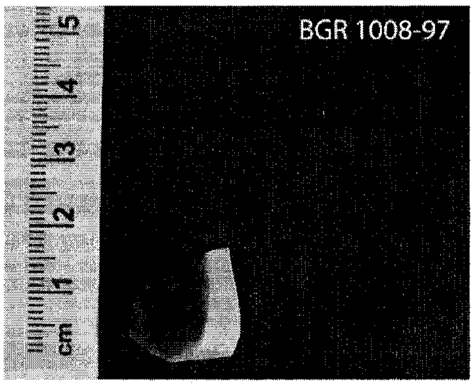

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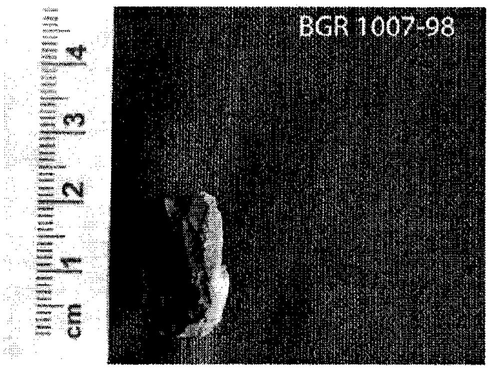

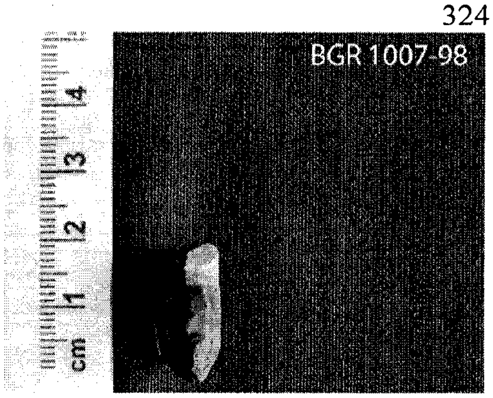

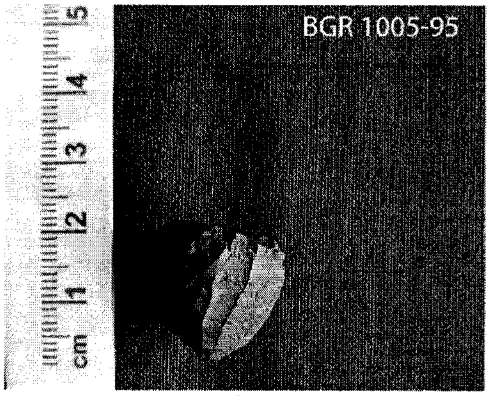

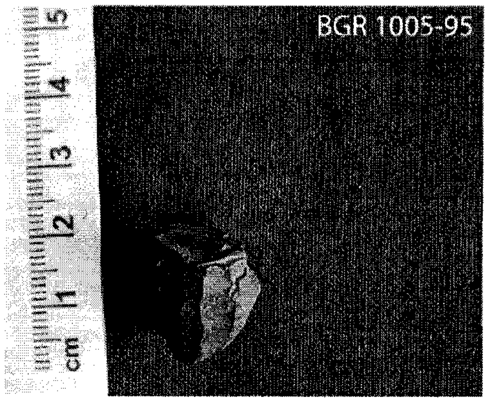

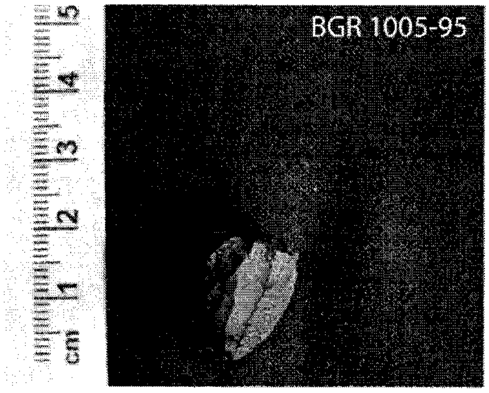

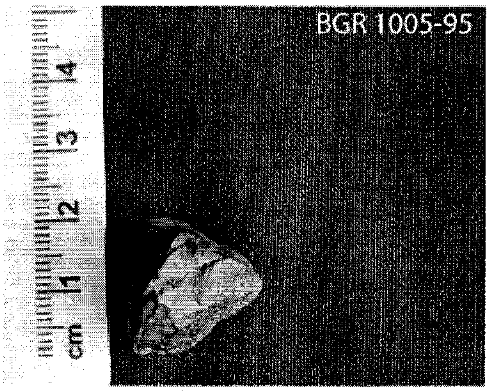

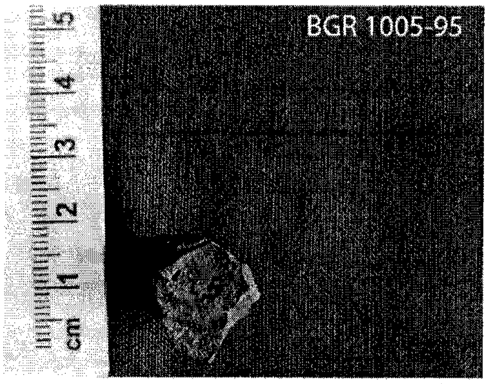

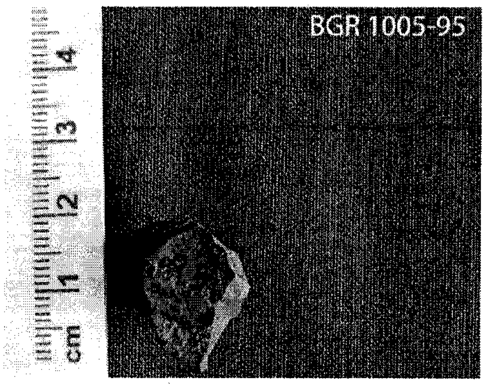

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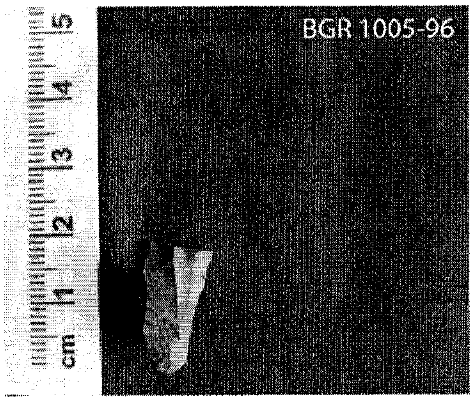

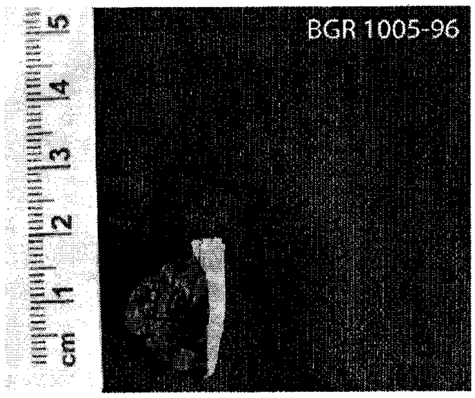

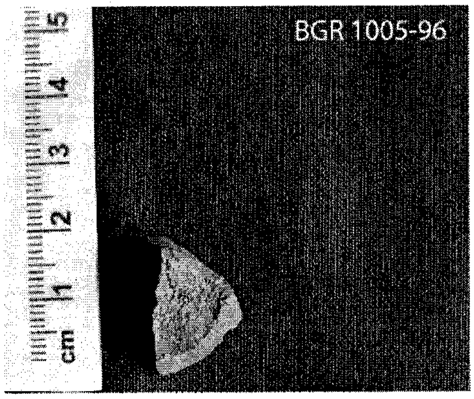

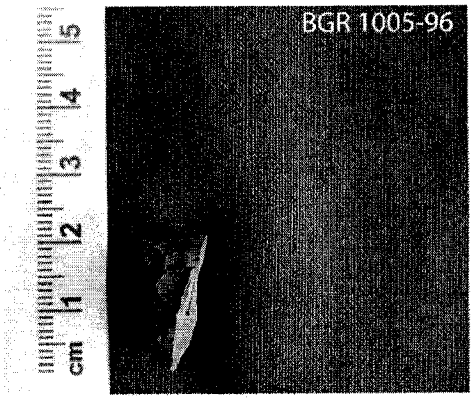

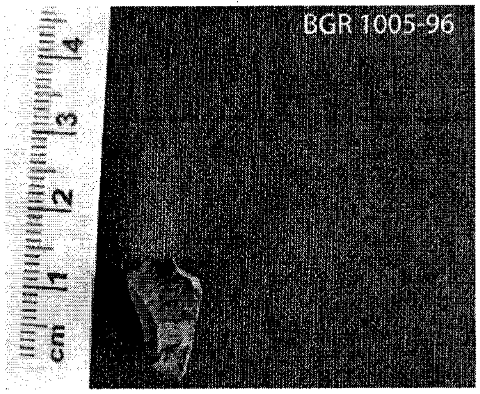

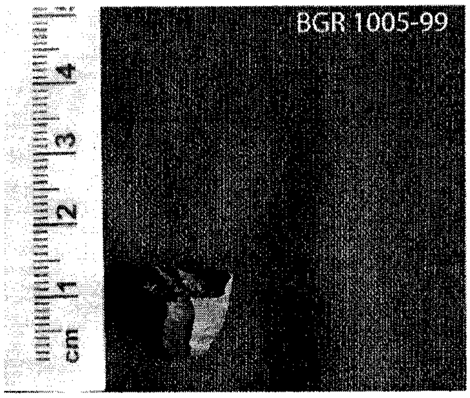

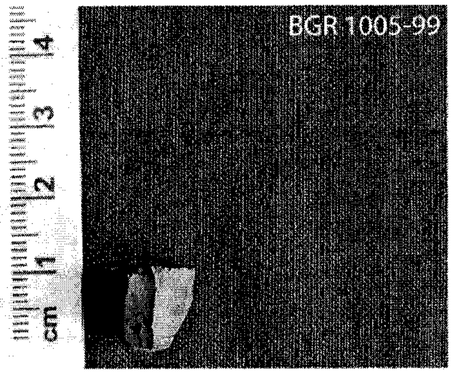

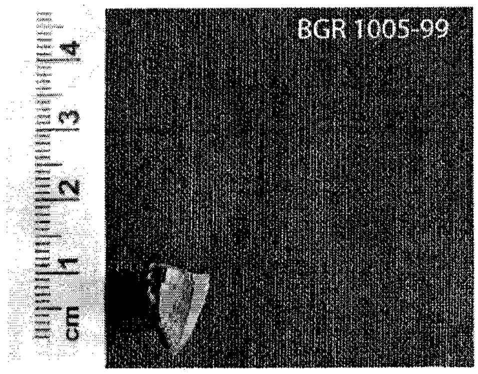

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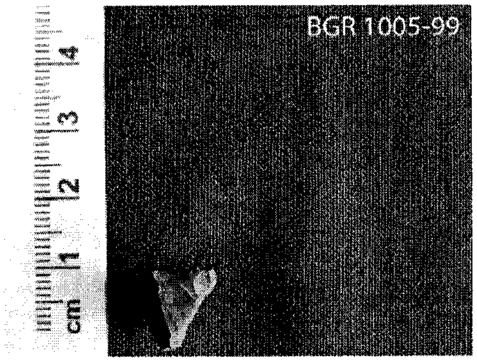

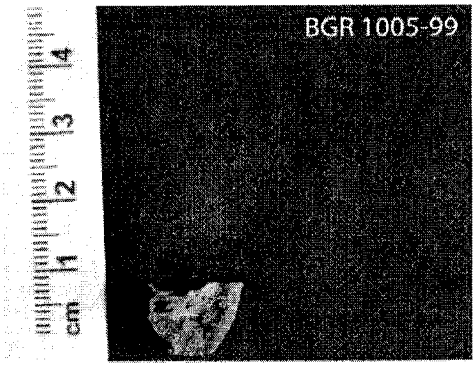

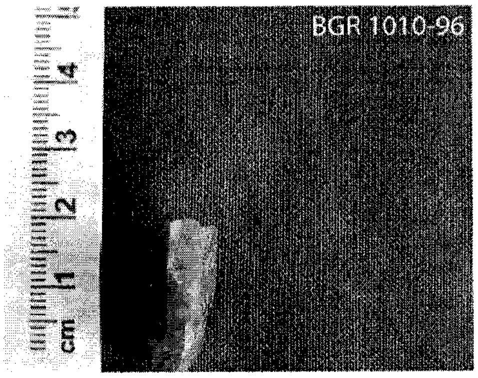

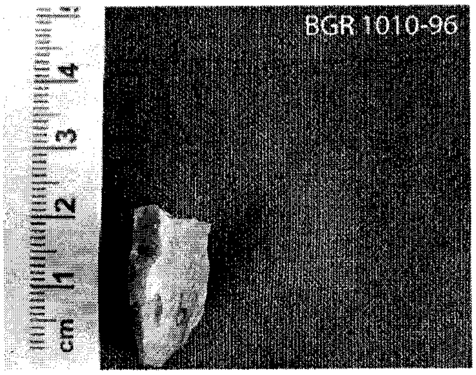

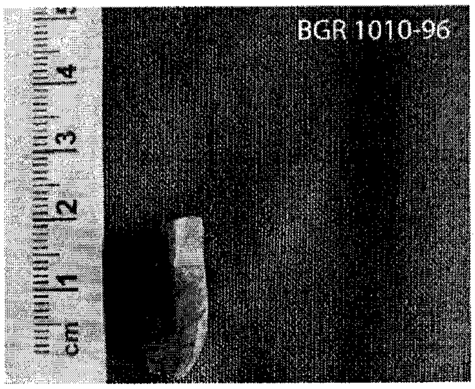

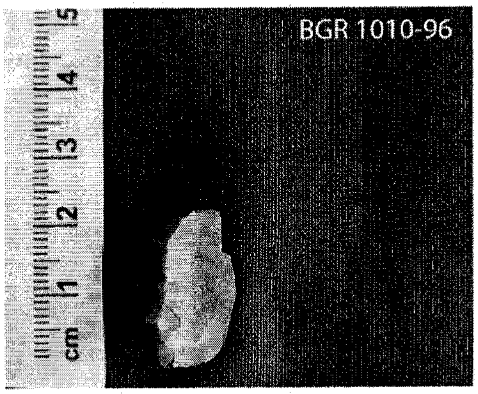

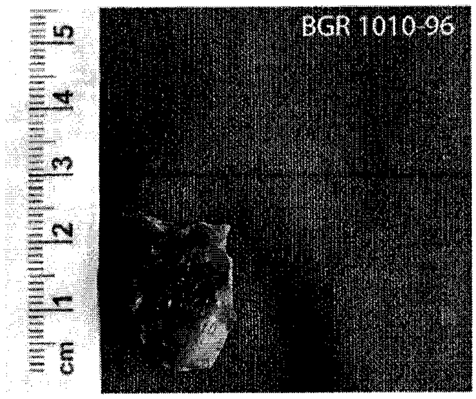

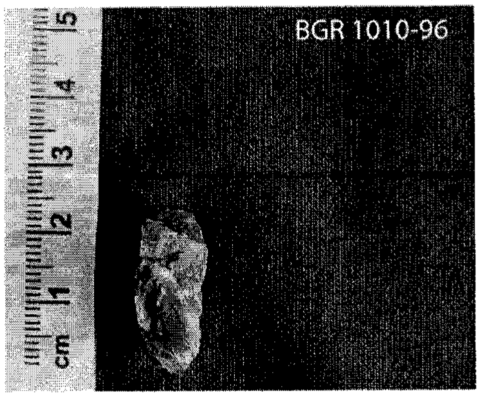

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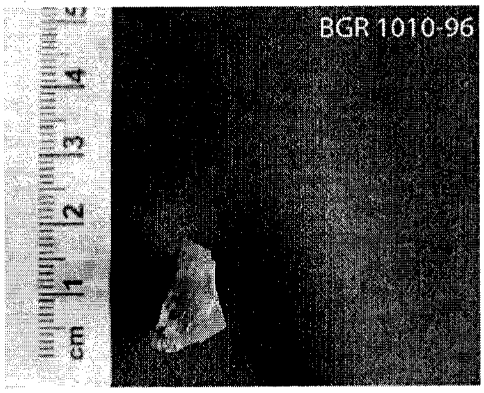

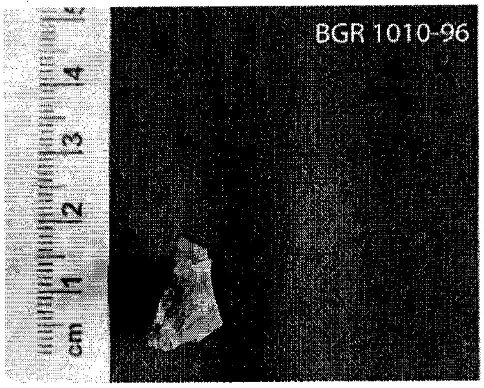

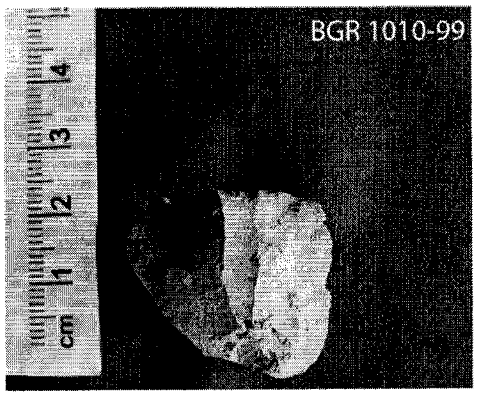

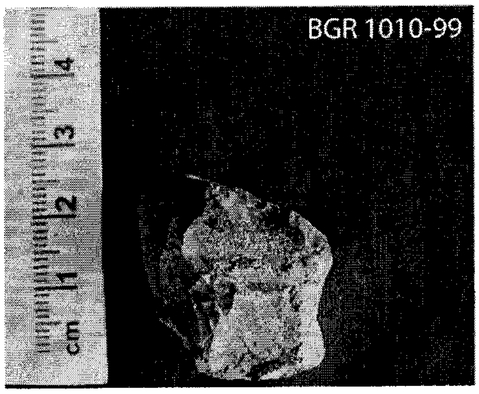

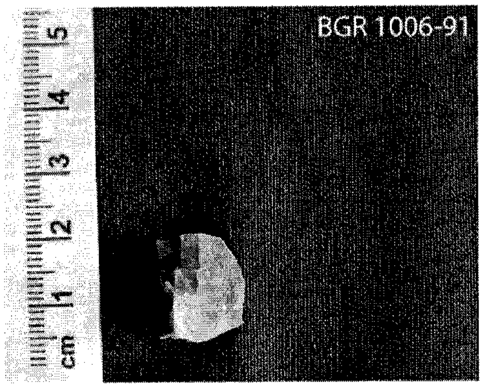

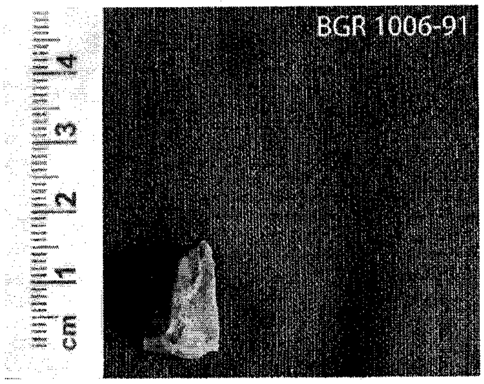

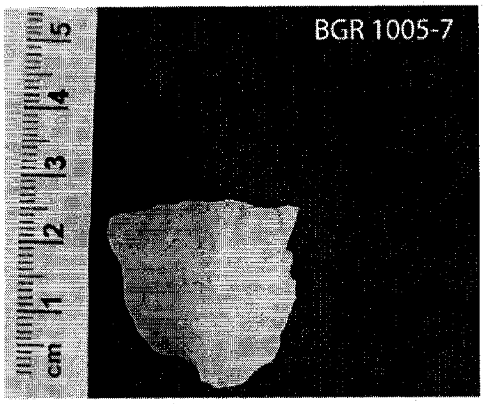

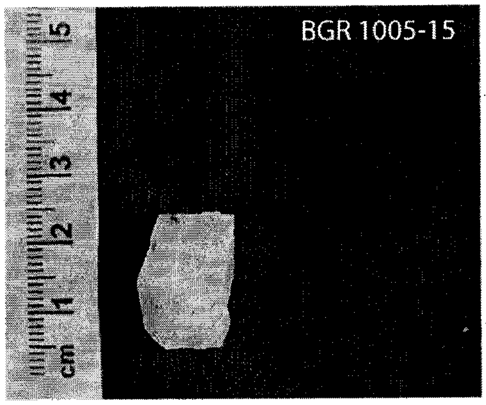

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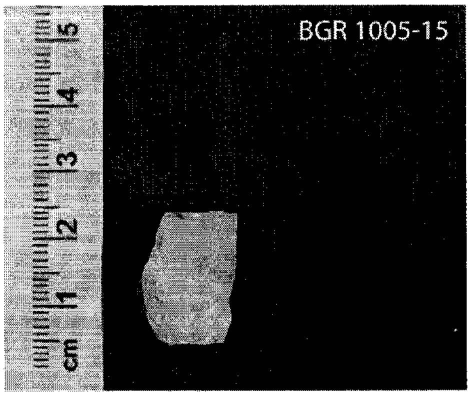

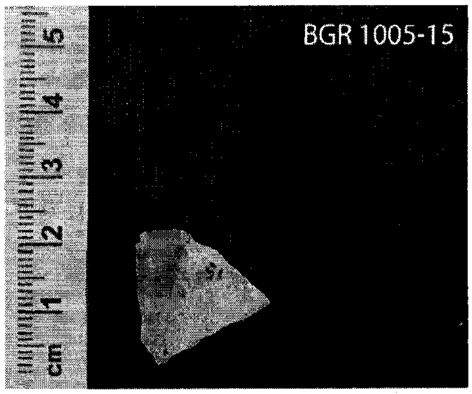

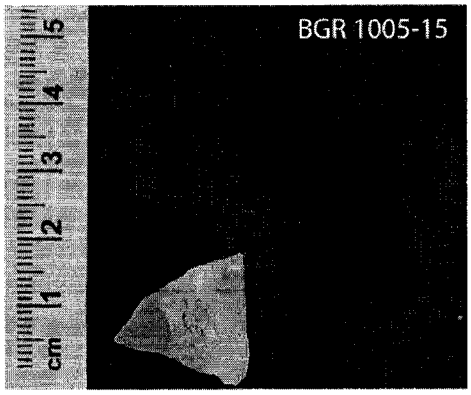

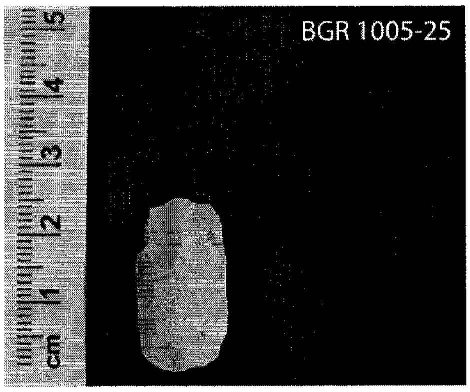

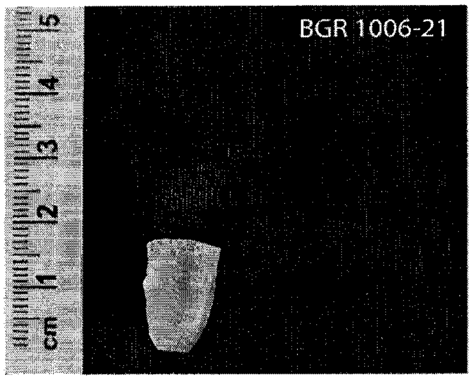

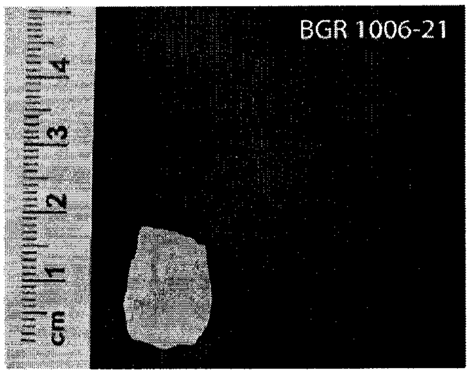

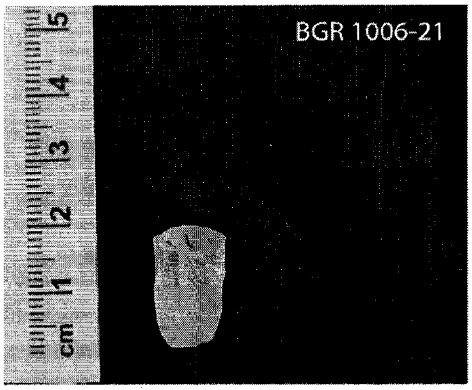

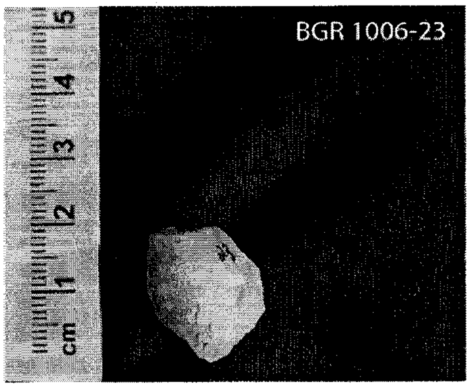

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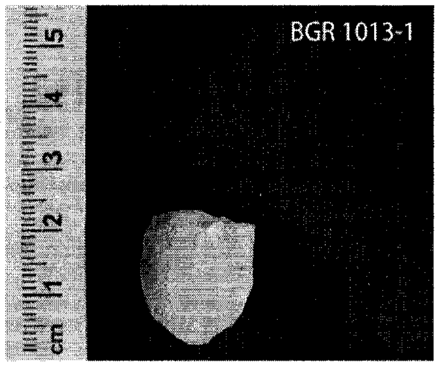

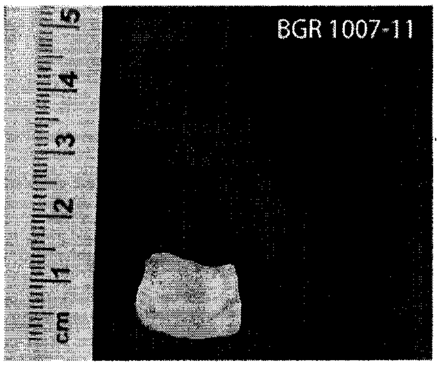

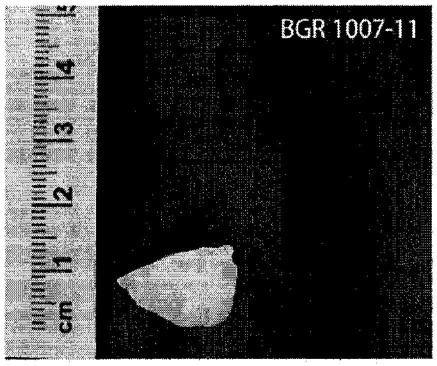

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Index

Ahar, 14, 39-42, 53, 56, 262
Balathal, 14, 16, 18, 37, 38, 41, 42-45, 56, 58, 100
Biface, 106, 108, 110, 113, 120, 128, 133, 176, 265, 278
Chaîne opératoire, 131, 132, 134
Copper, 1, 4, 8, 13, 14, 16, 17, 18, 31, 32, 34, 43, 45, 53, 58, 114, 147, 152, 153, 270, 283
Dhung, 84
Entrer Trois, 199
Expedient, 106, 110, 117, 124, 206, 275, 285
Ganeshwar-Jodhpura Cultural Complex, 28, 29-31, 47, 153, 157
Hafting, 158, 163, 200, 208, 212
Indus, 14, 27, 28, 31, 96, 97, 99, 102, 114, 153, 154, 158, 206, 266, 272, 276, 277
Khetri Copper Belt, 23
Langhnaj, 8, 95, 97, 98, 99, 100, 147, 154, 163
Lithic reduction, 133
Maldharis, 85
Marmi, 14, 16, 18, 37, 38, 45-47, 178
Mesopotamia, 92, 114, 278
Microburin, 151, 179, 199, 200, 208, 209, 267, 275
Ojiyana, 14, 16, 37, 38, 47-48
Organization of technology, 134, 139
Raika, 84, 85
Shatter, 175, 179, 196, 272
Shatter, 199, 201
Technological style, 74, 135
Tod, 39
Upper Paleolithic, 146, 151, 162

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